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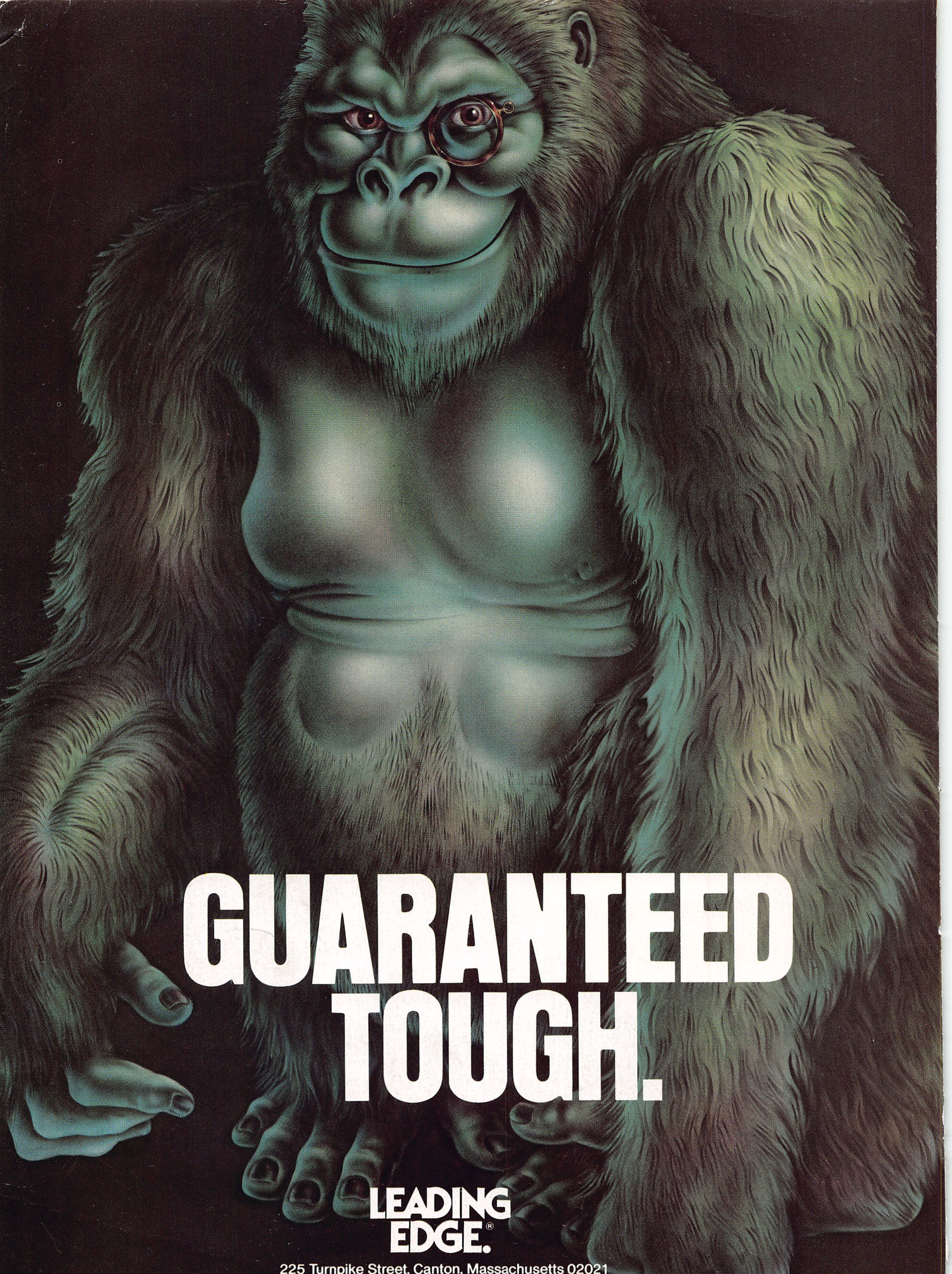
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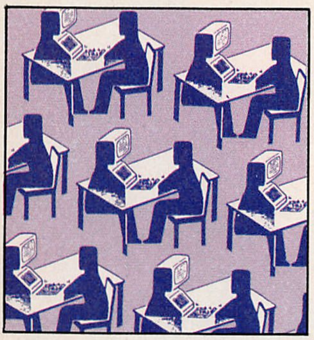
Vol. 2, No. 9 July 1983

FEATURES



82

Across Space and Time
by Rachael Wrege—Multiplayer games guide the spirit of play into the twenty-first century.

96

Osborne Retools for Modern Times
by A. Richard Immel—The Osborne 1's successors give you more features, a bigger video screen, and in one model, IBM compatibility.

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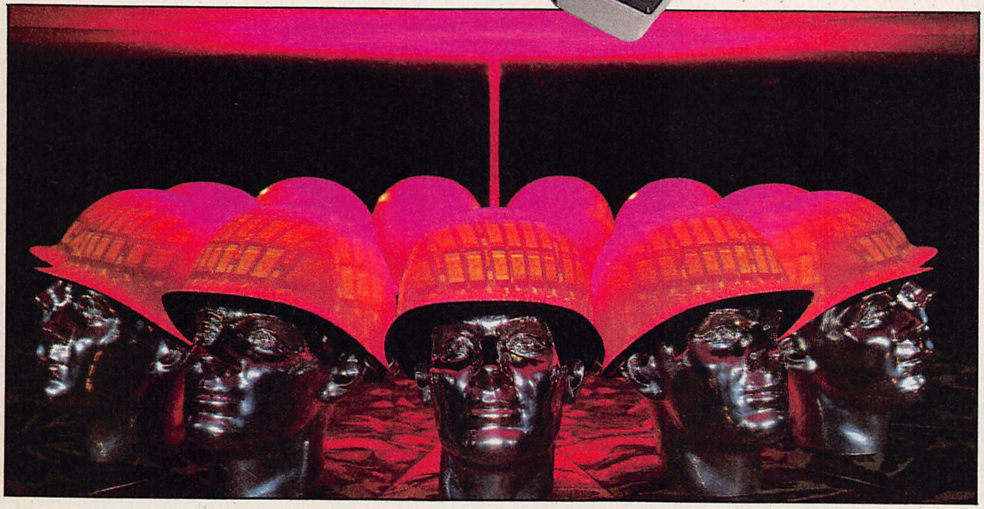

88

Computer Guerrillas
by A. Richard Immel—Beefing up their defenses against well-heeled bureaucracies, the little guys are marshalling forces and using the power of the microcomputer to help them stand up for their rights. And in many cases the long hours and hard work have paid off.

SPECIAL REPORT:

106 Introduction/The Top 40 Low-Cost Printers
by David B. Powell—A street-wise buyer's guide to printers that cost less than $1000.

114 The Buyer's Guide

138 Printer Buffers
by Ivan Berger—They let you use your computer productively while your printer is hard at work.

150

IBM's Personal Computer XT
by George Stewart—Hardly resting on its laurels, IBM has brought to market an improved version of its highly successful PC.

CONTINUED ON PAGE 4

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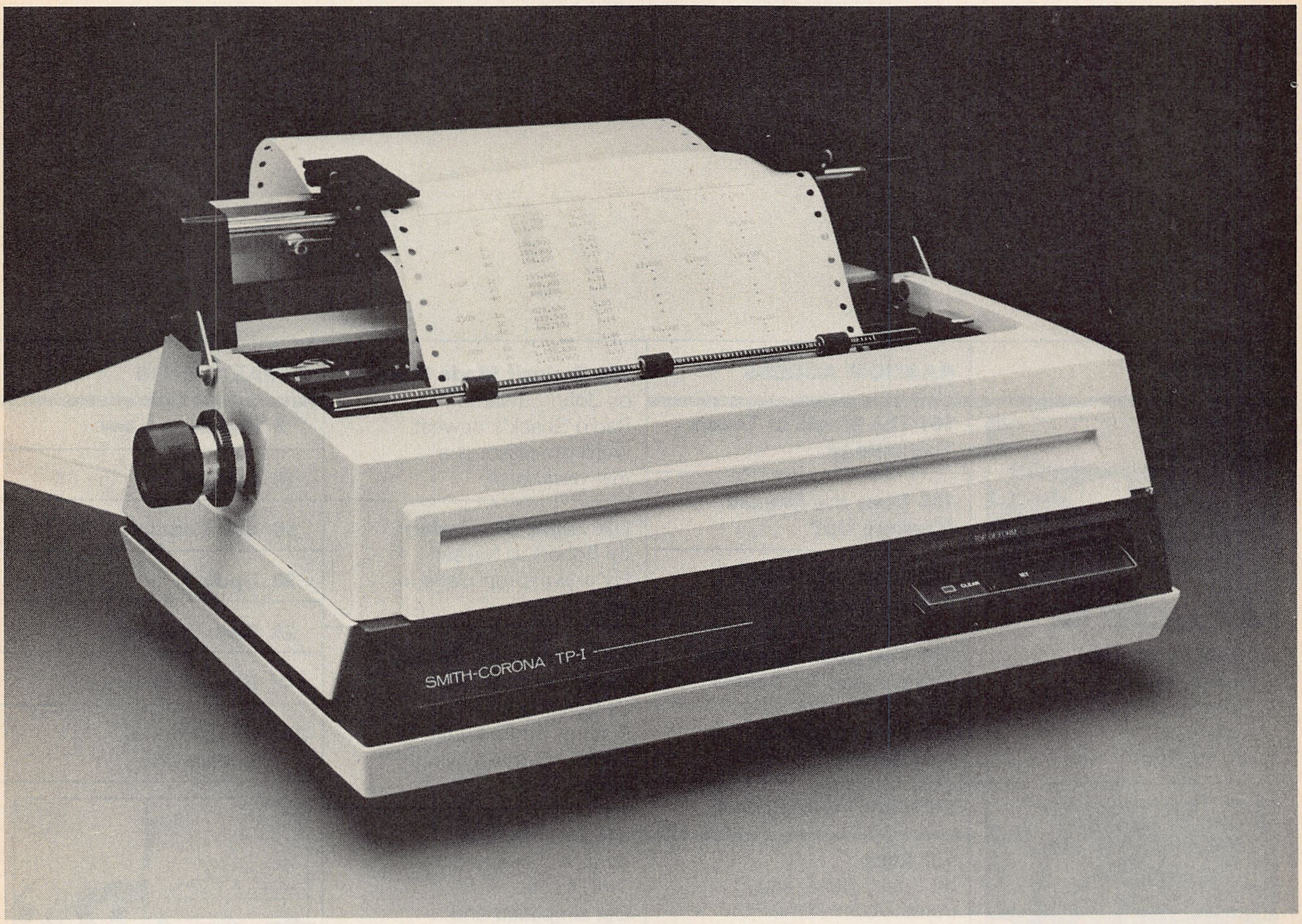

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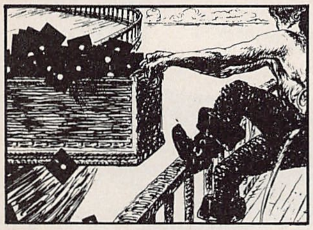
CONTENTS

COLUMNS



48 Small-Business Computing:
Is Software Piracy Justified?
by A. Richard Immel

58 What Do You Do After You Plug It In?
The Appliance Computer
by William Barden Jr.

65 Educational Computing
Games for Learning
by Dan Watt

70 Telecomputing
Dialing Dilemmas
by Steven Levy

RANDOM ACCESS

161 The Magic of Touch Technology

166 Does the Manual Measure Up?

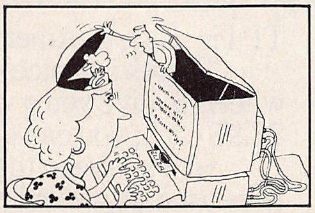
170 Used Equipment: Buyers Beware

174 The Unix Operating System and Its Clones

178 Process Cost Accounting

SOFTWARE REVIEWS

187 Eliza
by Shelly Heller and Judith Axler Turner
Turn your computer into a therapist.



192 Easy Project Management
by Robert Schilling Jr.
Visischedule appeals to the operations engineer lurking in all of us.

198 Scripsit Made Super?
by John Edwards
Radio Shack's newest word processor is a real workhorse.

204 Flight Simulation
by Robert J. Nielsen
Fly a twin-prop plane in your home.

210 Adventure Games Discover Graphics
by Jon Johansen
Pictures add new life to traditional role-playing games.

214 List Handler
by J. A. Love and T. C. Loder
Get simplified and flexible data management for the Apple II.

222 A Spreadsheet for Your Sinclair
by Ann L. Zevnik
Vucalc may be slow-footed compared to the big boys, but it's still worthwhile.

226 Maniac Mobile Mazogs
by Ann L. Zevnik
This may well be the breakthrough game for Timex/Sinclair computers.

DEPARTMENTS

6 Popular's View

10 Letters

16 Ask Popular

20 Update

28 New Products

43 New Software

231 Recreational Computing

237 Book Reviews

240 Reader Service

249 The Program Factory

255 Coming Up

Cover photo by Michael Jay

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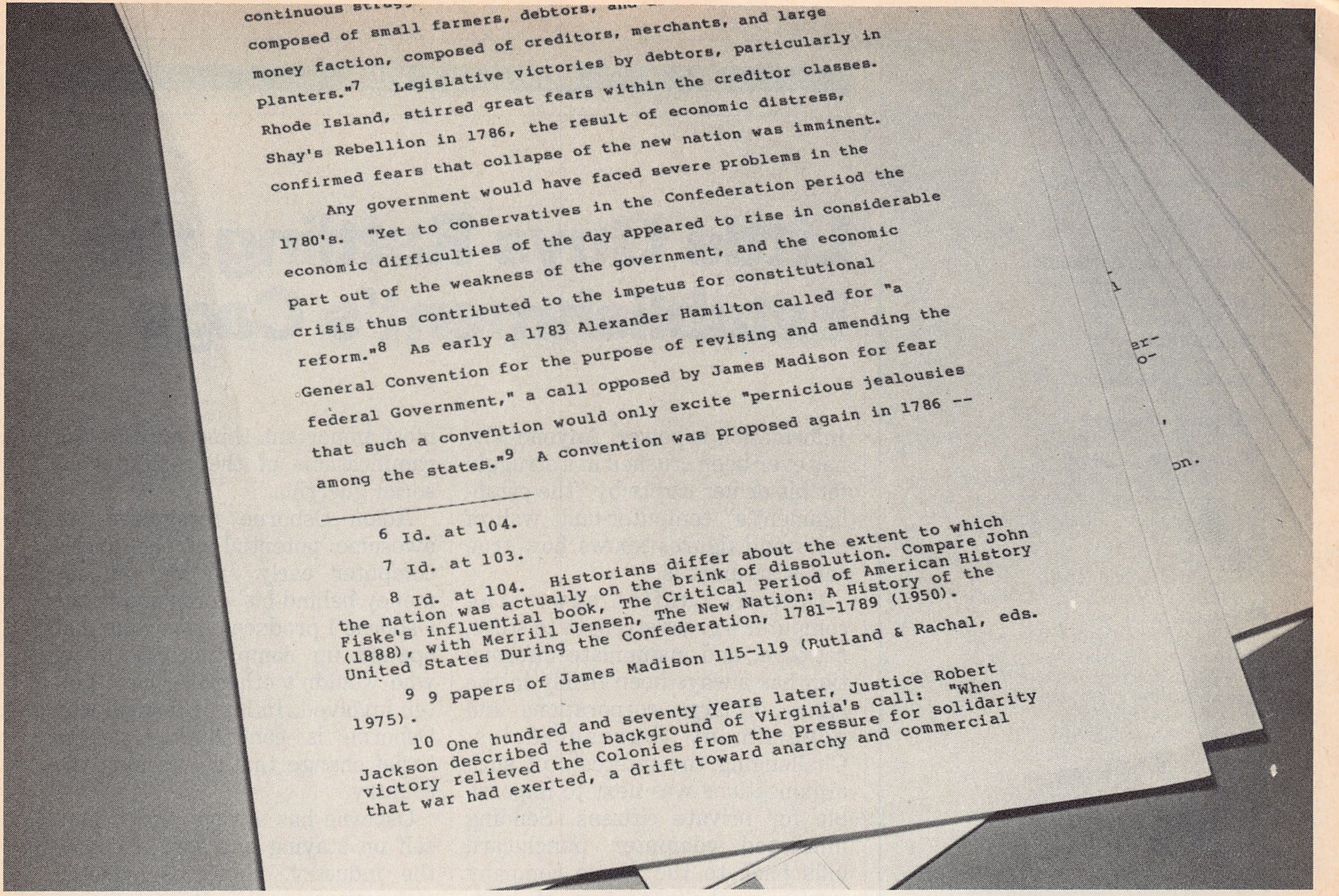

continuous strug
composed of small farmers, debtors, and
money faction, composed of creditors, merchants, and large
planters."7 Legislative victories by debtors, particularly in
Rhode Island, stirred great fears within the creditor classes.
Shay's Rebellion in 1786, the result of economic distress,
confirmed fears that collapse of the new nation was imminent.

Any government would have faced severe problems in the 1780's. "Yet to conservatives in the Confederation period the economic difficulties of the day appeared to rise in considerable part out of the weakness of the government, and the economic crisis thus contributed to the impetus for constitutional reform."8 As early a 1783 Alexander Hamilton called for "a General Convention for the purpose of revising and amending the federal Government," a call opposed by James Madison for fear that such a convention would only excite "pernicious jealousies among the states."9 A convention was proposed again in 1786 --

---

6 Id. at 104.

7 Id. at 103.

8 Id. at 104. Historians differ about the extent to which the nation was actually on the brink of dissolution. Compare John Fiske's influential book, The Critical Period of American History (1888), with Merrill Jensen, The New Nation: A History of the United States During the Confederation, 1781-1789 (1950).

9 9 papers of James Madison 115-119 (Rutland & Rachal, eds. 1975).

10 One hundred and seventy years later, Justice Robert Jackson described the background of Virginia's call: "When victory relieved the Colonies from the pressure for solidarity that war had exerted, a drift toward anarchy and commercial

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POPULAR'S VIEW

Little Guys Rattling the Establishment's Cage

Information is power. Anyone who has ever been crushed in a struggle for his or her rights by "the establishment's" computer-built wall of facts and figures knows how true this statement is.

Indeed, until now, the computer's great strength to store, retrieve, and manipulate information has always been firmly in the hands of large corporations and government bureaucracies. Challenging the interests of such organizations was next to impossible for private citizens. Sending mutilated computer punch-card bills back to the phone company was a symbolic protest at best. Vandalizing computer centers was not only illegal but meaningless. No wonder the sixties generation turned their attention to flowers and sex.

Enter the microcomputer. All of a sudden the little guys are using micros to even the odds in their fights against well-heeled bureaucracies. And in some dramatic cases they're even winning. It's not only the professional full-time protestors who have turned to microcomputers but also ordinary citizens who've never joined a peace march or contributed money to a political cause. These people, in growing numbers, are marshalling the powers of the micro to help fight for their social concerns.

As contributing editor A. Richard Immel says in his article "Computer Guerrillas" (see page 88), "One of the more important aspects of the information revolution we hear so much about may not be a personal computer in every home, the automated office of the future, or even so-called computer literacy for our children; the most important thing may be the ramifications of the computer as social guerrilla."

Adam Osborne recognized the awesome potential of the microcomputer early on. He put his money behind his words and in the Osborne 1 produced a machine that opened up computing for many who wouldn't otherwise have gotten involved. In his own small way Osborne is contributing to the social change that's sweeping the country.

Osborne has always prided himself on staying one step ahead of the industry. He's been quoted many times saying "no computer manufacturer can afford to rest on its laurels," and his new Executives (see page 96) prove that he listens to his own advice. In a nutshell, the Executives are adequate machines. Nothing fancy but the price and features will make them very desirable.

IBM's microcomputers are quickly establishing a de facto 16-bit standard. And Osborne, by jumping on the IBM compatibility bandwagon (obviously strongly motivated by future profits) is casting one more vote for much needed industry standards. With standardization come lower prices, a wider choice of software, and of course, more computing power for the masses.

Rich Fried

Rich Friedman
Managing Editor

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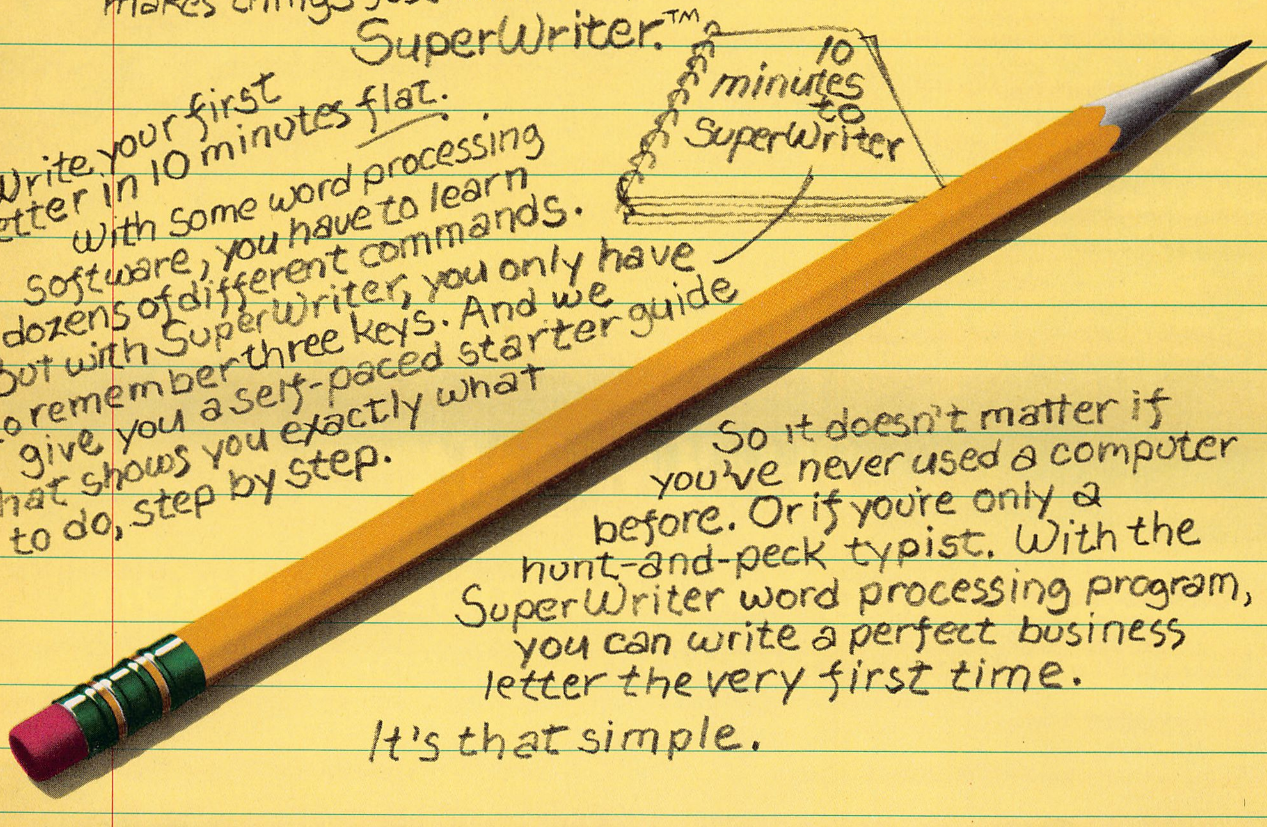

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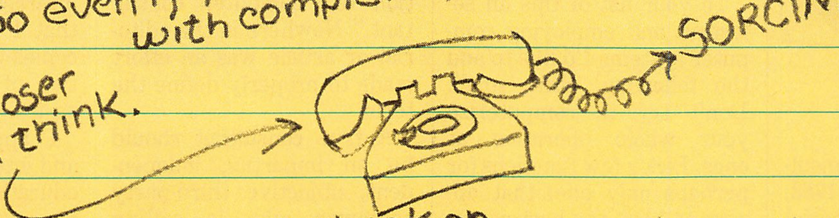

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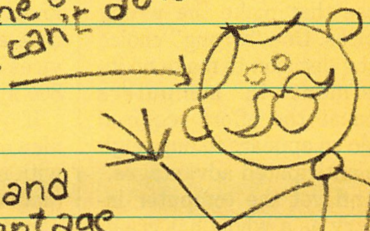

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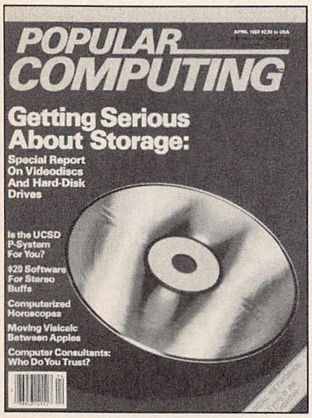
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Computer Consultants: Who Do You Trust?

Consultants Clash

Dear Editor:

The article "When Consultants Clash" (April 1983, page 96) and the editorial "Computer Consultants" don't begin to do justice to a problem that has become an integral part of the computer market environment.

Businesses that computerize intelligently, all other factors being equal, will be tougher competitors than those that make the wrong choices. One "wrong" choice is the decision to make no investment in computers because the effort required to do so appears to outweigh the anticipated advantages.

And yet the computer industry as a whole has created an ever-changing obstacle course for its potential customers. The industry, for the most part, sits smugly at the finish line waiting for those who make it through industry-generated jargon, a proliferation of computing languages, a lack of standards, a deluge of software, and the necessity for the user to become more involved with the computer than with any other piece of office equipment. Only the hardiest or most stubborn make it unaided and still resolute to the finish.

People want to buy and use computers the way they have been buying and using most of the tools of civilization—without major re-education, without learning a new language, and certainly without being made to feel foolish by the vendors. We want to be able to buy and use computers as easily as we buy and use typewriters or calculators or copying machines.

To your list of tips on selecting and employing computer systems I'd like to add the following: start small. Don't try to computerize your whole operation at once. Pick a few functions (or perhaps only one) that appear to have the best potential for making your investment pay off. Use your experience with those few functions as a guide to future steps. Don't be trapped into purchasing machines that do all sorts of things that either won't be used or won't return your investment. (I know of several businesses that are getting all the services they need from Atari 800 systems.)

If you have a reasonable idea of where you'll be going with one, buy an expandable (upgradable) system. Be prepared to be disappointed and to replace some of the first software you buy. Find a friend who knows your system and is willing to answer questions in detail during your break-in period. And use the new computerized system as a backup to normal procedures until you're sure that the new setup fits your operation and is reliable.

M. H. Norwalk
Computer Consultant
Cleveland, OH

Trust Common Sense

Dear Editor:

Having just read your editorial "Computer Consultants" and the article "When Consultants Clash," I feel compelled to address your comments about computer consultants. The article surely illustrates the potential for arriving at different system-selection conclusions during the acquisition of computer-based resources. However, the real problem lies with the definition of "computer consultant." Nowhere in the editorial or article was an effort made to properly define the term.

A true consultant should be an impartial, independent, objective third-party reviewer who is selling nothing but advice, information, and guidance concerning the client's potential computer activities.

The computer consultants described in your article were certainly not that type of consultant. If you call a custom-application software developer who writes programs for the North Star Horizon a consultant, then you deserve to get a "recommendation" for custom software for the North Star Horizon. If you call a computer-store owner a consultant, then you deserve to get a "recommendation" for a computer-store product, which the "consultant" conveniently sells.

Your editorial closes by suggesting that the first-time computer buyer should trust his "own common sense and intelligence." I agree. In so doing, the buyer will recognize that the integrity, judgment, knowledge, and unbiased analysis offered by the true consultant, who has no ax to grind, will provide indispensable support in making that tough first-time computer-acquisition decision.

John A. Wixson
Gastonia, NC

Rocky's Boots

Dear Editor:

I just finished reading the Educational Computing column "Informal Learning" (March 1983, page 60) on innovative software being developed by some of the small independent software publishers. The disks sounded so interesting and innovative that I immediately ordered copies of Rocky's Boots and two of the Snooper Troop series.

I appreciate the insight and intent of your articles on educational computing and hope you continue to use them to urge educators and publishers to both think about what they are doing and to raise the level of quality and imagination that goes into the development and use of educational software.

Gary R. Carlson
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Why So Slow?

Dear Editor:

I really enjoyed Paul Friedman's article, "Why is BASIC So Slow?" (January 1983, page 108).

One question: why isn't there an incremental compiler combining the convenience of an interactive pseudocompiler (IPC) with

Popular Computing welcomes your feedback regarding articles that appear in this magazine as well as your comments about the personal computing field in general. Write to Letters, *Popular Computing*, POB 397, Hancock, NH 03449. (Due to the number of letters received, we cannot respond individually.)

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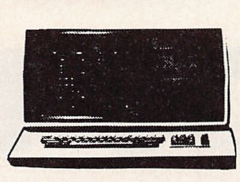

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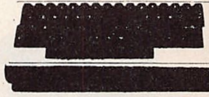

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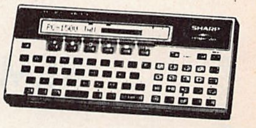

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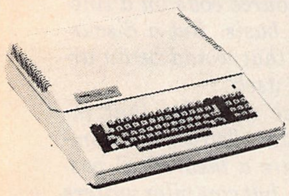

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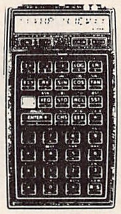

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Stephen Schneider
Blue Hill, ME

Good question. Actually, all compilers are "incremental" in the sense that they step through programs one line at a time, digesting each line and spitting out the appropriate machine code. Sophisticated "optimizing" compilers may go back through the code several times and make various improvements, but no compiler can read a program, analyze it as a whole, and then write out the machine-language translation. They all have to work on a program line by line.

So why can't a compiler output machine code as a user types in the source code interactively, the way an IPC outputs pseudocode? I guess it would be feasible to write such a compiler, but it would be technically messy. People have an annoying habit of making random changes in a program as they type it in, adding, deleting, and modifying lines at will. After a while, the lines of the program get scattered all over memory. This is no problem in pseudocode because each line has a pointer to the next line imbedded in it. At run time, the pseudocode interpreter can jump around in memory from line to line, wherever they're stored.

To do the same thing in machine code, you'd have to tack machine-language JUMP instructions onto the end of each line's code. Not only would that increase the amount of memory you'd need, but executing the jumps would slow down the program considerably. And speed is why you chose compiled code over pseudocode, right?

There are other problems, especially with regard to the fact that compiler optimizing routines alter the finished machine code so that it no longer corresponds to the source code on a line-for-line basis. But a discussion of that would be an article in itself.

*Suffice it to say that incremental "straight" compilers are a theoretical possibility, but compiler writers don't write them because incremental compilers involve awkward design compromises that defeat their advantages over pseudocode compilers. . . .***Paul Friedman**

Computer Lawyers

Dear Editor:

I want to compliment Scott Rosenberg on his article "Computer Lawyers" (April 1983, page 106) for his discussion of the failure of attorneys and law schools to respond to the legal aspects of the computer and information revolution. Campbell University School of Law, where I am Adjunct Professor of Computer Law, began offering a course in computer law three years ago. Campbell also requires each law student to take a course in the use of microcomputers in the law office and offers courses in the use of the Westlaw legal-research system.

As is typical for other high-technology areas around the country, the microelectronics and information industries located in Research Triangle Park offer excellent opportunities to private practitioners such as myself engaged in the wide range of issues involved in "computer law." Because of the pervasiveness of information technologies, lawyers and law students must develop a working knowledge of computers and computer law in order to provide complete services to clients who must rely on those technologies.

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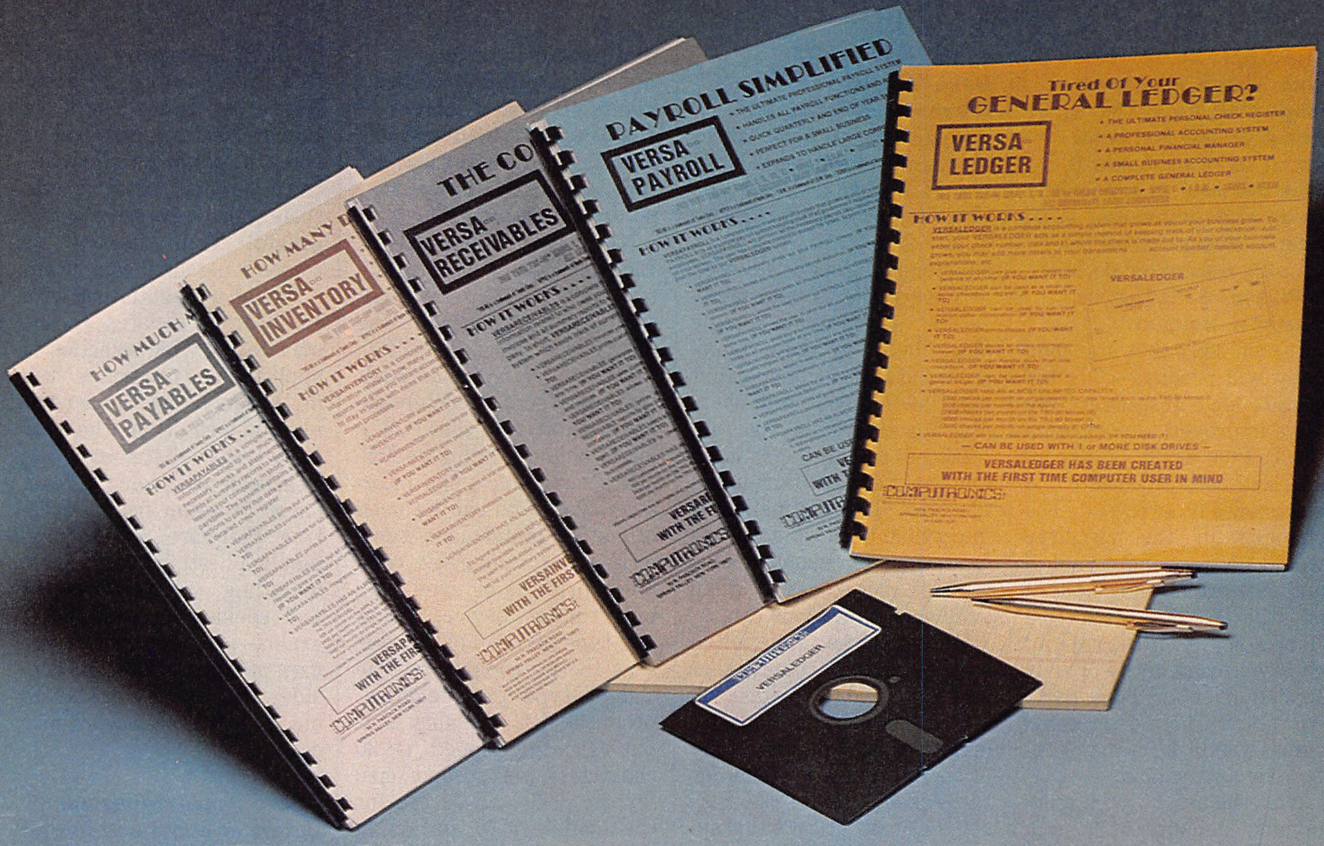

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ASK POPULAR

The Apple IIe, reviewed in your March 1983 issue (page 108), looks like a fine product. But what about all of us Apple II Plus owners? Is it possible to upgrade our units? Will boards designed for the IIe plug into older IIs and II Pluses? S. R. Dufour, Brussels, Belgium

It's unlikely that any company will produce a IIe upgrade kit. Installing the IIe's improved keyboard on the II Plus would be expensive and both physically and electronically awkward. The changes in the circuitry would be even more radical and cost-prohibitive. Last of all, the IIe has two LSI (large-scale integration) chips not used in the II or II Plus; duplicating these parts without infringing on copyrights would be a major effort for any company.

Nonetheless, by adding individual enhancement cards and modifications (all of which have been around for years), you can give an Apple II or II Plus some of the IIe's features such as an 80-column display, upper- and lowercase keyboard, 16K-byte random-access memory (RAM), and 64K-byte RAM expansion.

Boards that plug into the IIe's expansion slots should work on the II Plus. However, boards that plug into the IIe's special auxiliary slot *cannot* be used on the older models, and it is unlikely that any company will devise an interface that would make this possible.

I understand that most of the hard disks available for microcomputers limit individual files to the size that would fit on a floppy disk. Are there some systems that permit the user to have files as large as the disk itself? Dave Gilberg, Cleveland Heights, OH

Being able to have larger files is one of the great benefits of a hard-disk system. Updating or sorting through huge databases is much simpler if the data is stored in a single file. If your application demands a single large body of data, maximum file size is an important point of comparison in shopping for a hard-disk system.

It's not the hard disk itself but the software that limits file size. The distinction is important because software limitations can usually be removed more easily than hardware limitations can.

Hard-disk space is often segmented into volumes that correspond to floppy disks in terms of storage capacity and access techniques. Many of the hard-disk systems for the Apple II and IBM Personal Computer take this approach and limit file size to that of a floppy disk.

On the other hand, new systems for the Apple III, Radio Shack TRS-80 Model 12, and IBM Personal Computer permit files far in excess of floppy-disk capacities.

One last suggestion: if you plan to create hard-disk files too large to be stored on a single floppy disk, be sure the operating system provides a means of backing up a file on a *group* of floppy disks. Without this capability you would be unable to make a safe copy of your entire file.

I've read about modification kits that allow typewriters to be used as computer printers, and I'm wondering if there is a unit specifically designed to be used as both. I'd like to find a rugged product that produces letter-quality output and comes equipped with a professional typing keyboard as well as a computer interface. Alfred Kohlberg Jr., New Carrollton, MD

NEC Information Systems Inc. (5 Militia Dr., Lexington, MA 02173) sells three products that might fill the bill: Spinwriter models 3520, 7720, and 7725. Called KSR (keyboard send-receive) teleprinters, each of these units has a keyboard plus an RS-232C communications interface. The units can be used offline as stand-alone typewriters or online as computer printers or even computer input devices (what you type on the keyboard is sent to the computer). The thimble-type print element produces letter-quality output. Printing speed is 30 characters per second (cps) for the 3520 and 55 cps for the models 7720 and 7725. Prices range from $2000 to $3455.

For a look at some of the more economical alternatives on the market, see our special report on low-cost daisy-wheel printers (January 1983, page 82).

We own three Lanier word-processing units. With great envy we have read of the marvelous variety of software available to people using personal computers. Is there any way we can run CP/M-compatible programs and use modems and other personal computer peripherals? Mac Seligman, Miami, FL

Help is on the way from Lanier Business Products Inc. (1700 Chantilly Dr. NE, Atlanta, GA 30324).

At the time of this writing, the company is putting the finishing touches on a CP/M-80 operating system licensed from Digital Research Inc. Users of Lanier EZ-1 systems will be able to purchase the software on disk, load it into their word processors, and presto! Your Lanier becomes a personal computer.

Lanier is negotiating with Lifeboat Associates to ensure that a wide selection of applications programs will be available on Lanier-format 5¼-inch disks. The company will distribute the Peachcalc electronic spreadsheet program from Peachtree Software. Other popular applications will follow, including word-processing and spelling-correction programs—a somewhat ironic turn of events when you consider that the EZ-1 started out as a dedicated word processor.

I have Apple II Plus computers at home and in my office. The office machine is connected to a 20-megabyte Corvus hard disk, which I'd like to be able to access from my home. Both computers have CP/M cards and modems that enable my home computer to talk to my office computer.

The problem is that I can't get the office computer to start CP/M. When it asks me, "Ready to boot CP/M (Y/N)," I am unable to make it recognize my response.

To gain access to my

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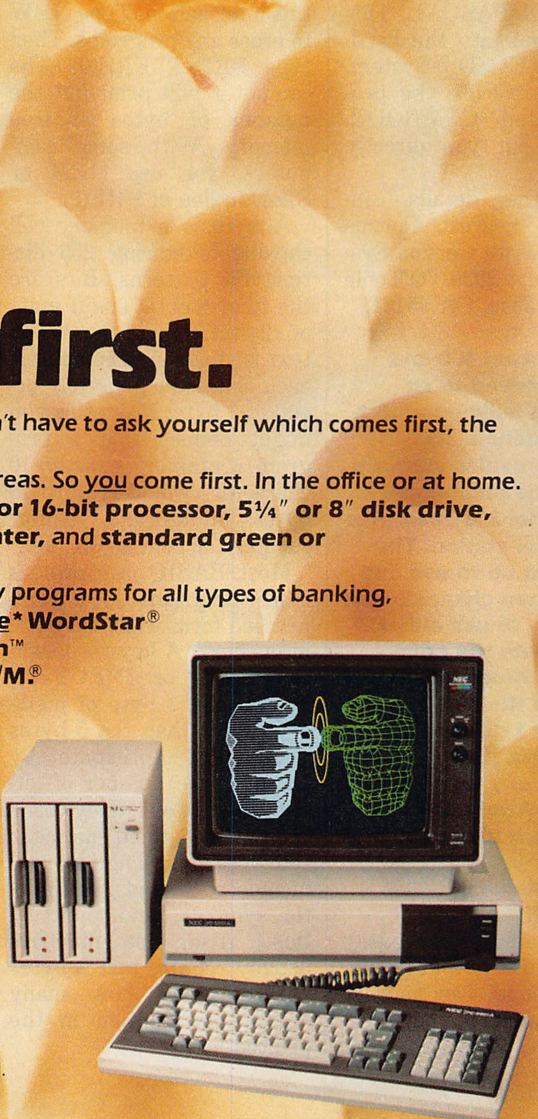

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files, I must get into CP/M. Can you help?
Joseph B. Sparkman, Portland, OR

A product manager at Corvus believes that the problem lies in the software you're using to handle the automatic-answer function and suggests the following solution.

You are apparently using the single-user hard-disk software from Corvus. If you get the multiuser Constellation version, you will not be asked the "Ready to Boot CP/M" question and therefore will not be stopped at this point.

With the Constellation software installed, you will call up the office computer and type in the BASIC command RUN PASCAL. This will get you into the hard-disk-based UCSD p-System. You then execute the program called CPMBOOT. This will put you directly into CP/M.

For further details, contact your nearest Corvus dealer or write Corvus Systems Inc., 2029 O'Toole Ave., San Jose, CA 95131.

I own an Atari 400 and recently moved to an apartment building with a master antenna. The building provides subscription service on channel 2, and channel 3 is used by a commercial station. The Atari is set up to use one of these two channels, but when I try to use either channel with the computer, the broadcast signal scrambles the picture even after I disconnect the antenna.

Is there any way to make my Atari use channel 4, which is unused in my area?
Earle A. Malkin, Chicago, IL

Your computer can easily be modified to output its signal on channel 4 or another unused channel in your area. All you need is a different crystal in the computer's built-in RF (radio-frequency) modulator. For details, contact your nearest authorized Atari service center.

Is it possible to tell how much memory a BASIC program requires by looking at the program listing? Several times I've typed in a long program only to discover that my computer doesn't have enough memory to run it.
Ariel Moreno, Morelia, Michoacan, Mexico

Here are several guidelines that will help you come up with a good estimate. First find out how much free memory your computer has. In Microsoft BASIC, the FRE(0) function gives you this information. Type NEW to erase any programs. Then type PRINT FRE(0). The computer will print out the number of bytes of free memory. With some computers, you use MEM or SIZE in lieu of FRE(0).

A byte is a memory cell capable of storing 256 distinct bit patterns. Bits are the fundamental on-off units of digital computers. When text is stored in a computer, each character generally occupies 1 byte. From this you might deduce that a program containing exactly 10 characters would require 10 bytes of storage. Unfortunately, it isn't so simple.

Most BASIC interpreters store programs in a compressed form while they are in memory. A keyword such as PRINT or INPUT requires only 1 byte of memory rather than the 5 bytes you might anticipate by counting the number of letters in the word. (Keywords are the predefined character sequences of a language and include commands, arithmetic symbols, and punctuation.) Also, line numbers usually require just 2 bytes regardless of how many digits they contain in the printed listing.

Try to verify these observations by typing in the following three programs and command sequences in the order given. Press Enter or Return at the end of each line.

```
NEW
10 PRINT
PRINT FRE(0)

NEW
10 PRINT: PRINT
PRINT FRE(0)

NEW
10000 PRINT:PRINT
PRINT FRE(0)
```

The command PRINT FRE(0) causes the computer to print out the amount of unused memory. You may be surprised to see that adding :PRINT used up just 2 bytes of your computer's memory; the colon uses 1 byte and the keyword PRINT uses another. The 5-digit line number 10000 uses the same amount of memory as the 2-digit line number 10.

This compression of keywords and line numbers means that most programs occupy fewer bytes in memory than the number of characters they contain when printed out.

For a first estimate of the memory requirements of a program, count the keywords in the program and figure 1 byte of storage for each. Add 2 bytes for each line number reference in the program. Now count the characters used in variable names and the characters enclosed in quotes. If spaces are used inside quotes or as separators between keywords and variables, count them as characters. Finally, add 3 bytes for each line of the program. The total sum will give you a reasonable approximation of how many bytes the program will occupy in your computer's memory.

But you're not through yet. Programs consume more memory while they are running, sometimes much more. Take variables as an example. In Microsoft BASIC, integer variables require 2 bytes of storage, single-precision variables require 4 bytes, and double-precision variables require 8 bytes. The space requirement of a string variable is determined by the maximum length the string reaches during program execution. For each variable used in the program, add the appropriate number of bytes to the earlier total.

Some versions of BASIC let you set aside a certain amount of space for strings. The CLEAR statement serves this purpose. CLEAR 250 reserves 250 bytes for strings. If a program includes a CLEAR, you needn't calculate storage requirements of individual strings; instead, just add the number specified after CLEAR (250 in our example).

Arrays really eat up memory. To find out how much an array will need, take the product of the array's dimensions and multiply that by the number of bytes each array element requires (depending on whether the array is integer, single-precision, or double-precision). For example,

```
10 DIM A(24,5)
```

creates a 25 by 6 array of single-precision elements and requires 25 × 6 × 4 = 600 bytes.

The computer gives up additional memory to perform intermediate calculations for housekeeping operations, but we can ignore these hard-to-figure storage requirements and still come up with a close estimate.

Let's take a short program as an example and estimate its memory requirements. The italicized number to the right of each line indicates the bytes of memory required just to store the line.

```
10 INPUT A,B                 10
20 C=A*B                     10
30 PRINT "TOTAL IS"; C       19
```

When we run the program, an additional 12 bytes will be required for storing the values of the three variables. Thus, the technique described above gives us a total estimated memory requirement of 51 bytes.

Try some of these tests on your computer. Your numbers will almost certainly vary from ours—there isn't enough "storage space" in this column to give you a truly comprehensive set of procedures—but the trends you discover should be similar. After you've experimented with various programs you'll get pretty good at estimating how much space a program will require in your computer.

How many bytes are in a megabyte?
Walter S. Foster, Friendship, ME

The capacity of hard disks is usually measured in megabytes.

Many people are confused about just how big a megabyte is. Loosely, a megabyte is 1 million bytes. (The metric prefix *mega-* means million.) However, because computers count in binary rather than decimal numbers, a megabyte strictly contains 1,048,576 (2 raised to the power of 20) bytes.

A few years ago, a similar confusion arose concerning the term kilobyte, which should represent 1000 bytes according to metric usage but actually signifies 1024 (2^{10}) bytes according to computer arithmetic. Computer jargon solves the problem by using K instead of *kilo-* to indicate 1024, and thus the term K byte.

By analogy, we could use M instead of *mega-* when we mean 1,048,576, and indeed several computer trade journals follow this style. Until the megabytes outnumber the K bytes, however, we'll continue to spell out the word and hope that those extra 48,576 bytes don't get lost through the cracks of your computer's memory.

Recently I purchased a used TRS-80 Model I Mini Disk Drive at a flea market. I had it checked out at the local high school, and it works great. Can it be hooked up to my Atari 800?
Ed Wyspianski, Norwich, CT

It's never simple to connect one computer's disk drive to another computer, but the match you have in mind is especially unlikely.

The Atari 800 expects a disk drive to be "smart"—capable of responding to fairly high-level commands. Drives designed for use with this computer have their own microprocessors.

The Radio Shack Model I disk drive, on the other hand, is a much more elementary device. It's simply an electromechanical mechanism; the smarts (the floppy-disk controller, for example) are built into the expansion interface.

In short, they just weren't made for each other.

What happens if you try to print out a variable before you give it a value?
Avi Friedman, Vancouver, British Columbia, Canada

A few BASIC interpreters (such as Hewlett-Packard's) give you an error message if you reference a variable before defining it. However, Microsoft BASIC, the most common version, takes a more indulgent approach. If you reference an undefined variable, the computer uses a value of 0 (or the null string if a string variable is referenced).

For the sake of clarity in program design as well as portability, it's best to initialize all your variables. If you ever try to convert your programs to run on a compiler version of BASIC, you'll find that initialization is mandatory. □

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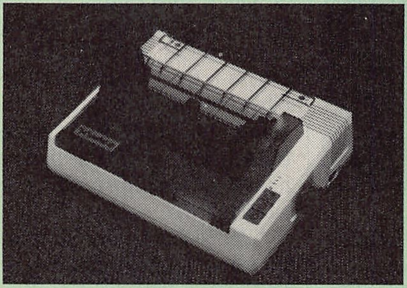

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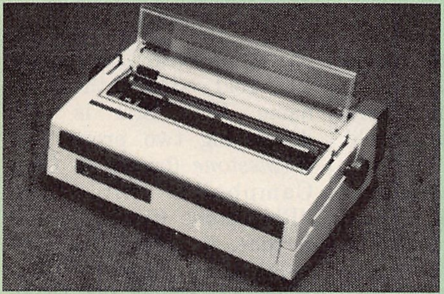

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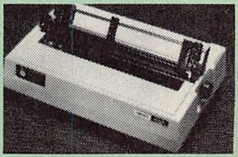

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Interface Keeps Pete Rose Hustling

The word "interface" puts many people to sleep, but Philadelphia Phillies stars Pete Rose and Mike Schmidt are sweating, not snoozing, thanks to Interactive Structures Inc.'s AI13 analog-to-digital input interface for the Apple II and IIe. Phillies head trainer Jeff Cooper uses the $550 interface (which includes start-up software) to monitor players' muscular strength as they push against Cybex, a Nautilus-like exercise machine designed by Dr. Jim Richards of the University of Delaware.

When Cybex is interfaced to the Apple, the athlete simply goes through a normal workout while the trainer examines the plot onscreen. For example, when Rose flexes his knee six times, Cooper sees 12 humps on the monitor—one for each flex and one for each release.

"The AI13 interface allows Jeff to bring an injured player along at the appropriate speed," says ISI's Dr. M. Joseph Willson. "Most professional athletes have equivalent strength in their left and right legs, while the nonathlete generally has one leg that's as much as 10 percent stronger. By using the computer to analyze what Pete Rose's healthy left leg is capable of, Jeff knows exactly what to do if there's a 15 percent performance dropoff following an injury." Cooper and his assistants can also print hard copies of the screen display because the Phillies have purchased Interactive Structures' PKASO interface card.

is
Interactive Structures Inc.
Data Acquisition System AI 13
15
0

If Pete Rose injures a muscle on the diamond, Phillies trainers can monitor his recovery using a Cybex machine linked to an Apple with an AI13 interface.

"The Apple II interface business is prospering at the moment because of the economic recession," Willson continues. An Apple II, after all, costs about a tenth of what you'd pay for a dedicated lab computer. Our product is being purchased by the organizations that can afford a big DEC system but prefer to buy five Apples instead."

ISI's 16-channel A/D interface has plenty of applications outside professional sports. Ed Brazil is an avid water-skier/programmer who last summer used the AI13 interface to create an automatic metering system at the Marine World Jump in Redwood City, California. The arc, speed, and distance of each water-skier's jump were obtained electronically in just a few seconds. Physicians at Philadelphia Children's Hospital are using the Apple II interface to monitor babies for signs of heartbeat and breathing irregularities.

"There are really no limits to the applications," says Willson. "We're talking about the marriage of the Apple and this interface to whatever analog device you can dream up." □

Planning Video Game Tie-ins

Although movie moguls are anxious to have their blockbusters marketed as video-game spin-offs, very few of them think about game tie-ins as they evaluate film scripts. Likewise, game programmers seldom take the initiative in peddling movie rights to their creations. That's just poor planning, according to Fernando Herrera, Bill Blake, and Dick Spitalny, principals in a new company called First Star Software that develops strategies for game/movie tie-ins.

Independent filmmakers Blake and Spitalny are old hands at taking a hit from one medium and transferring it to another. Their most successful film venture to date, *The Night the Lights Went Out in Georgia,* was based on Vicki Lawrence's 1973 gold record of the same name. First Star is now developing two properties, *Rhinestone* (based on Glen Campbell's hit tune "Rhinestone Cowboy") and *Arcade,* in both movie and video-game formats. The game version of the latter

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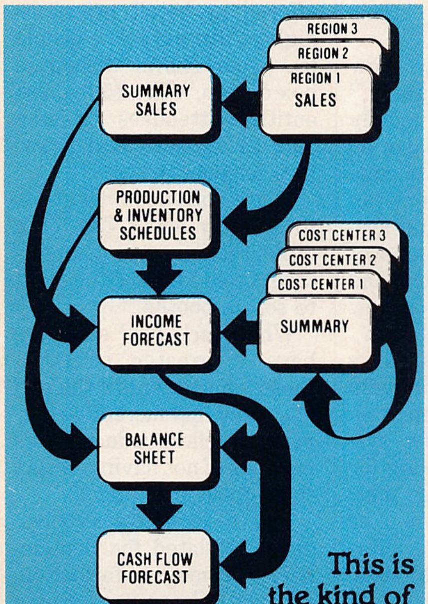
If you use a 'calc' package to do multiple spreadsheet budgets and forecasts, you'll be familiar with the problem of moving data from one spread sheet to the next, in the appropriate sequence. With some 'calc' packages you have to re-enter the data manually onto the next spreadsheet.

With more than 5 or 10 spread sheets, it becomes a complicated process to execute each spread sheet in the proper sequence, and get the proper data values transferred to the next sheet.



This is the kind of inter-related model PLAN80 automates with ease

PLAN80 Consolidates Automatically

To create a PLAN80 model like the one in the flow diagram above, you use your editor or word processor to create disk files. These files specify the report TITLES, COLUMN and ROW descriptions, initial DATA values, and the RULES (formulas), for each spreadsheet.

In this manner you design individual spreadsheets (and/or duplicate similar spreadsheets) for each part of the model e.g. Sales Region 1, Sales Region 2, Cost Center 1, Income forecast, etc.

Next you create CONTROL files which use powerful PLAN80 commands to execute each spreadsheet in the correct sequence. These CONTROL files cause each spreadsheet to be computed, printed and/or displayed. They also **consolidate** spreadsheets where required and store specific data values for use by subsequent spreadsheets including the financial statement forecasts.

Finally, you create a simple MASTER CONTROL file which will execute the other CONTROL files **automatically** in the correct sequence. Then you "run" your model by entering a TWO WORD command like **"A > PLAN80 MSTRCTRL"**.

Powerful But Easy To Use

This PLAN80 technique allows you to build models of **unlimited** size and complexity. But PLAN80 is easier to use than "calc" packages, because you write the model files, with **your own familiar word processor or text editor**. And the commands are written in simple English so you can **understand them months later**, e.g. MARGIN = SALES – COSTS.

Check These PLAN80 Features

- **If-Then-Else Logic** ☑
- **Compute in any Sequence** ☑
- **Input Values while Running** ☑
- **Automatic Replication** ☑
- **Interactive "What-If" Mode** ☑
- **Screen Graphics** ☑
- **28 Functions** including:
  - Sum/Cum/Avg/Min/Max ☑
  - Depreciation/ACRS ☑
  - Amortization/NPV/IRR ☑
  - Lookup/Spread/Shifting ☑
  - Trigonometric/Math/Log ☑
- **Report Formatting**
  - Up to 6 decimals ☑
  - Commas, $'s, ()'s ☑
  - Under/Overscores/Spaces ☑
  - Auto-print & Paging ☑

PLAN80 also has the ability to store your finished reports on your disks so you can incorporate them into written reports with your word processor.

Mainframe Modelling Power at Micro Prices

PLAN80 was designed by a man with years of experience in mainframe modelling to bring mainframe features to the CP/M *or MS-DOS* user, at micro-computer prices. PLAN80 is perfect for Financial Planning, Property Management, Tax Planning, Engineering, Production, Market Simulations and Investment Analysis.

---

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* MS-DOS is a registered trademark of Microsoft Corp
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INFOWORLD rated the original version of **PLAN80** as **excellent** in all 4 categories: **Performance . . . Documentation . . . Ease of Use . . . Error Handling**. It has been greatly enhanced since then to provide even more power and features.

Try PLAN80 for only $69.00 Risk-Free

PLAN80 currently retails at $495.00, but for a limited time you can order it directly from **Executive Software** Inc. at $295.00 AND SAVE $200.00. Or order our FULL-POWERED DEMO version with manual for only $69.00 and return it for a full refund (except shipping) if it doesn't fit your application.

The DEMO disk has all the power and features of PLAN80 but limits your models to only 4 columns. This will permit you to create and test your own working consolidated model. Then call us to get the normal version of PLAN80 and RECEIVE FULL CREDIT for the cost of the demo.

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PLAN80
PLAN80

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Buffalo, N.Y. 14202

In Canada:
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R.R. #3, Barrie, Ont.
L4M 4S5

O.K., Please rush me my PLAN80 manual & diskette for my computer (MAKE)________ (MODEL)________
Disk: ☐ 5¼" ☐ 8" **Density:** ☐ Single ☐ Double
Sectored: ☐ Hard ☐ Soft **System:** ☐ CP/M80 ☐ CP/M-86 ☐ MS-DOS **CPU:** ☐ Z80 ☐ 8080 ☐ 8086/8088 Note: PLAN80 requires 56K RAM (128K RAM — CP/M-86 or MS-DOS)
TO:
Name________
Company________
Address________ City________
State________ Zip________ Phone________
☐ I want ________ copy(s) of PLAN @ $295.00 ($359. in Canada)
☐ I want ________ copy(s) of PLAN80 DEMO @ $69.00 ($79. in Canada)
with FULL REFUND or CREDITING privileges.
Add $5.00 for shipping. N.Y and Ont. residents add sales tax. ☐ Check enclosed ☐ Mastercharge ☐ Visa
Card #________ Expiry________
Signature________
☐ I need more info., send brochure to above address

Circle 67 on inquiry card.

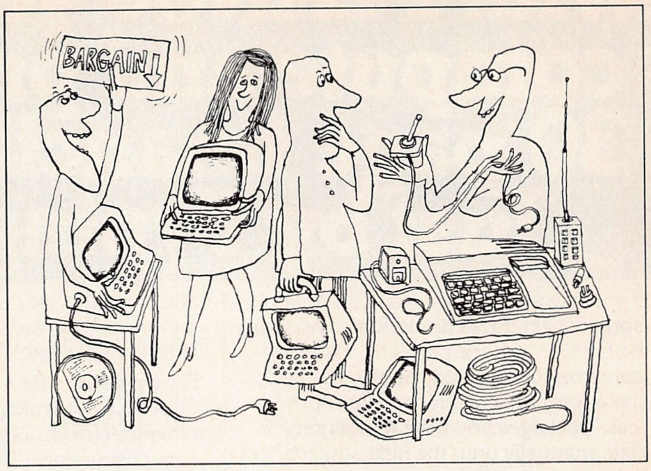
was programmed by Herrera, a hacker elevated from obscurity after winning the top prize of $25,000 in Atari's first annual Star Award of Merit competition.

"I always have been some kind of artist," says Herrera. "I used to paint, fiddle around with photographs, make small films. I found the computer to be another way for me to create."

Herrera was so smitten with the programming bug that he quit his job with a New York City architectural firm and became manager of Computer Concepts, a computer store on Long Island. There he met Blake, one of the store's investors. This was not long after Blake and Spitalny had gone to several leading video-game manufacturers trying in vain to set up some joint ventures. After getting rebuffed by the game companies—*and* after meeting Herrera, their programming Picasso—the filmmakers decided it was much smarter to develop screenplays based on his programs (and vice versa). First Star is also in the business of consulting to other moviemakers, who might otherwise get less than they deserve for video-game rights.

Spitalny believes that First Star is simply the first of many independent companies that will help "interface" the film and video-game industries in the '80s. "Video-game arcades and game software for home computers grossed three times what Hollywood did last year," he stresses. In a market that lucrative, First Star's founders may wind up like the hero of "Rhinestone Cowboy"—"getting cards and letters (and software and joysticks) from people they don't even know." For more information about the company's pending projects, write to First Star Software, 22 East 41 St., New York, NY 10017. □

Computer Swap America



Unlike other computer shows, this one isn't filled with talking robots, glistening booths, or the latest technological achievements from the big-name vendors. This one sports tables jam-packed with used disk drives, slightly "handled" software packages, printer ribbons and paper supplies. It's John Craig's Computer Swap America—Silicon Valley's thrice-annual high-tech flea market that rivals Gandhi's funeral when it comes to foot traffic.

John Craig, the entrepreneur behind Computer Swap America, is a former computer magazine editor. To date, his swap-a-thons have each drawn an average of 7000 people. The event, held at the Santa Clara County Fairgrounds in San Jose, California, brings out swappers of every stripe—from hackers on down to rank novices. This is no genteel, Sotheby's-style affair, says show director Casey Doughty. Weeks before the show, manufacturers are encouraged to "clean out those back rooms," she says. The attendees who mill about the plain brown tables—sometimes arguing over who saw what item first—are primarily looking for "slightly damaged in shipping" gear (terminals, printers, etc.), although brand-new items are hawked as well.

"People come to the show from all over the country," Doughty explains, mostly because merchandise can be had at a fraction of normal retail costs. "Beginners can purchase used computer systems and get their feet wet before they go out and spend thousands of dollars on new expensive gear," she adds.

Some show goers, says Doughty, are seeking buyers for their used equipment so they can finance new systems. Others are looking for advice on upgrading their hardware inexpensively, or simply want to share information with other hobbyists.

Admission is $5 at the gate and almost everyone comes to buy, says Doughty. "High-gloss shows are for looking at the latest products from manufacturers because almost everything is offered at retail prices or higher. But very few people leave our shows without a box or two." The $5 fee also entitles attendees to take part in auctions and drawings for door prizes.

Those with personal goods to sell pay about $40 for a table; retailers and manufacturers pay $125 for the right to set up booths.

While early-bird shoppers have a greater selection, those who stay until the end of a show find incredible bargains as sellers reduce prices in hopes of not having to cart their goods back home.

The next Craig extravaganza is slated for September. For more information, contact Computer Swap America, POB 52, Palo Alto, CA 94302. □

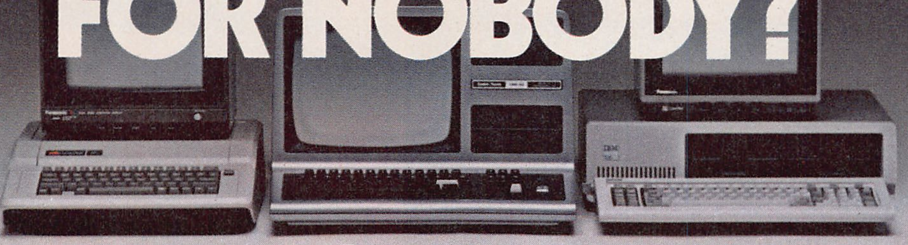
Texas Software Scouts

Each year hundreds of good software packages seem to slip through the cracks—they never get reviewed in the computer magazines and are omitted from the software directories. So suppose you're a veterinarian specializing in the treatment of neurotic felines, and you've moved heaven and earth trying to find a software package that's perfectly tailored to that one application. Do you toss in the towel and hire someone to write a custom program? Not if you're a subscriber to Sofsearch, a San Antonio, Texas, software locator service. Sofsearch president Tim Shirley doesn't dish out any hokey mottos ("If we can't find your dream software, then it doesn't exist"), but he does guarantee that his employees will conduct their software quest with all the conviction of Lara looking for Dr. Zhivago.

Sofsearch maintains the largest commercial software database in the world, with over 30,000 programs on file. A regular subscription costs $175 per year and entitles you to five separate software searches (and quarterly updates that might pertain). The Sofsearch report—which reaches the subscriber's hands within 48 hours—is essentially a compilation of one-page informa-

Illustrated by Jo Teodorescu

IF PERSONAL COMPUTERS ARE FOR EVERYBODY, HOW COME THEY'RE PRICED FOR NOBODY?



$1395* APPLE® IIe 64K

$999* TRS-80® III 16K

$1355* IBM® PC 64K

A personal computer is supposed to be a computer for persons. Not just wealthy persons. Or whiz-kid persons. Or privileged persons.

But person persons.

In other words, all the persons whom Apple, IBM, and Radio Shack seem to have forgotten about (including, most likely, you).

But that's okay. Because now you can get a high-powered home computer without taking out a second mortgage on your home.

It's the Commodore 64. We're not talking about a low-priced computer that can barely retain a phone number. We're talking about a memory of 64K. Which means it can perform tasks most other home computers can't. Including some of those that cost a lot more. (Take another look at the three computers above.)

By itself, the Commodore 64 is all the computer you'll ever need. Yet, if you do want to expand its capabilities some day, you can do so by adding a full complement of Commodore peripherals. Such as disk drives. Modems. And printers.

You can also play terrific games on the Commodore 64. Many of which will be far more challenging than those you could ever play on a game machine alone.

And as great as all this sounds, what's even greater-sounding is the price. It's hundreds of dollars less than that of our nearest competitor.

So while other companies are trying to take advantage of the computer revolution, it seems to us they're really taking advantage of something else:

Their customers.

*Manufacturers' suggested list prices as of March 20, 1983. Monitor included with TRS-80 III only. Commodore Business Machines, P.O. Box 500R, Conshohocken, PA 19428; Canada–3370 Pharmacy Avenue, Agincourt, Ont., Can. M1W 2K4.

commodore
COMPUTER

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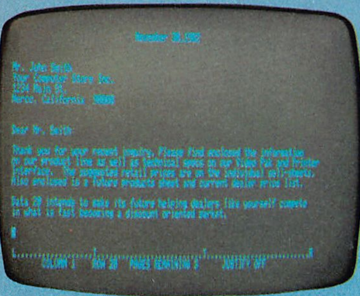
DATA 20's easy to buy, easy to install, easy to use peripherals are available for both VIC 20® and Commodore 64® Our enhancements give you more power, more sophisticated capabilities and now…

Free software with any VIDEO PAK. WORD MANAGER, our exclusive word processing package is full of advanced features. Combined with our VIDEO PAK, it gives your VIC 20 or Commodore 64 capabilities found only in the most expensive word processing programs. Like full-function status display, and up and down scrolling, plus 13 advanced editing features including merging and block move. In addition, we've included complementary mailing list programs. All are written in machine language for fast execution and minimal memory requirements. They're self-documenting and exceptionally easy to use. A self-adhesive strip for function keys makes most commands one-key simple. So simple, in fact, that we've eliminated the need for time-consuming menus and prompts. WORD MANAGER is provided on tape—and can be loaded to disk. It's yours free with any VIDEO PAK you pick.



New! Our lowest priced VIC 20 VIDEO PAK ever.
We've just introduced a highly cost-effective 8K version. Price it out!

Just pop this cartridge into your expansion port, and your display instantly goes to the industry-standard 24 lines, with a choice of 40 or 80 characters. Displayed this way, you'll know exactly what you're going to get on the printout. And you really increase the amount of data you can see on the screen. You also increase memory in the process—to 12K to handle more sophisticated functions. Our package includes a terminal emulator and screen print feature. Plus the free WORD MANAGER software package!

80
Z-80
Z-80 VIDEO PAK
DATA 20

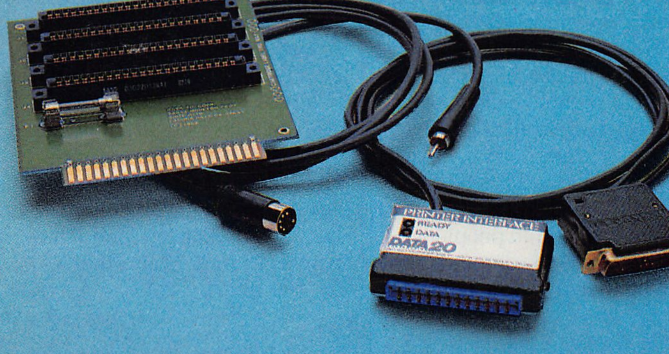
VIDEO PAK 80 for Commodore 64. Move up to the industry-standard 80-column format, and you'll wonder how you ever did without it! Use software control to go from 40 to 80 characters in monochrome—and back to 40 characters in color. With VIDEO PAK 80, you can take full advantage of the

FOR BOTH COMMODORES

terminal emulator mode and screen print feature with software we include. And this is a great package for word processing— particularly with our free WORD MANAGER software.

Z-80 VIDEO PAK brings complete CP/M® compatibility to your 64. This exciting peripheral gives you all the VIDEO PAK 80 features described above—plus! You see, our built-in microprocessor and software give you CP/M compatibility for any of the many programs formatted for the Commodore 1541® Disk Drive. The possibilities are truly awesome! And the WORD MANAGER software is free with your purchase.

VIDEO CABLE completes the installation. It's the easy way to connect your VIC 20 or Commodore 64 monitor to VIDEO PAK. And a must for 80-column use.



PRINTER INTERFACE in serial. Here's the perfect connection for your VIC 20 or Commodore 64. With our interface, you just plug in and go. We have a simple, yet sophisticated interface that offers flexible, continuous monitoring of data transfer functions—and virtually troubleshoots its own easy installation.

EXPANSION CHASSIS lets you use 4 cartridges at once. Run a series of compatible memory, software or game cartridges of any make on your VIC 20. Anything with the standard 22-pin edge connector. A built-in 500ma fuse protects your power supply.

16K MEMORY CARTRIDGE
DATA 20

MEMORY CARTRIDGE boosts VIC 20 brainpower to 20K. This super-reliable cartridge features the finest quality components, housed in a rugged plastic case.

Check out our AWESOME peripherals. Ask your dealer for a first-hand look at our extensive capabilities, high quality, and reasonable prices. Or send for a current catalog and price list.
DATA 20 CORPORATION, 23011 Moulton Parkway, Suite B10, Laguna Hills, CA 92653.

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DATA 20
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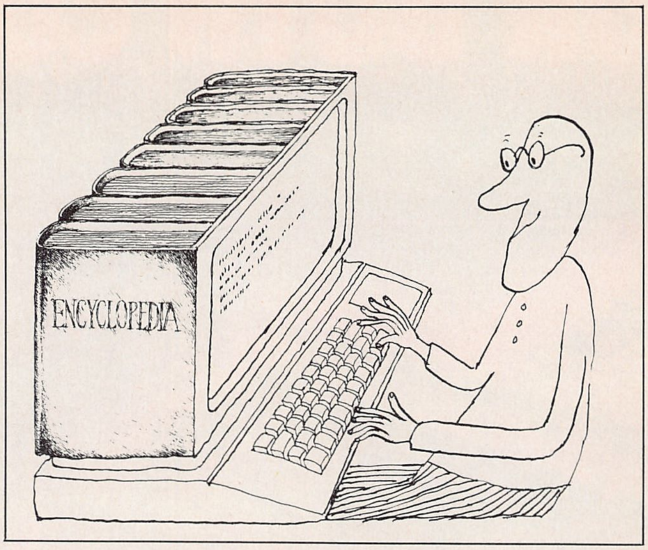
Price/Performance Peripherals

NOW WITH FREE SOFTWARE!

tion sheets on every known software package in the category you've specified. These summary sheets are *not* software reviews; they're similar to the "At a Glance" boxes seen in our magazine, listing product name/description, vendor name and address, operating systems, minimum memory requirements, source language, phone numbers, and price. If the online search proves fruitless, Sofsearch goes into "manual override" as employees start thumbing through their Rolodex files for the phone numbers of specialty software distributors. In addition, regular subscribers receive quarterly "Practical Advice" reports on how to be smart software shoppers.

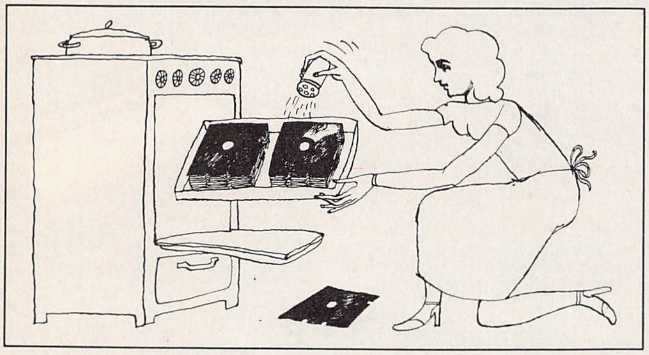
"We're offering a unique service," says Tim Shirley, "in that most computer retailers stock only about 200 software packages, and most of those titles are games." Indeed, 90 percent of Sofsearch's clients are business users who are scouring for products less frivolous than Frogger. For example, one of Sofsearch's most satisfied customers thus far is the engineer who turned to them after searching in vain for a hydrology and dirt-balance program. Since levee-checking software doesn't sell as briskly as Visicalc, the client had all but abandoned hope of ever finding an off-the-shelf program—until Sofsearch made good on its 48-hour pledge.

If your search for the perfect software has gotten about as frustrating as the quest for the Holy Grail, write Sofsearch International Inc., POB 5276, San Antonio, TX 78201, or phone (800) 531-5955 (in Texas, call (512) 340-8735). □



First Complete Online Encyclopedia

In our April 1983 issue, columnist Steven Levy observed that online databases are seldom as extensive or easy to use as they're cracked up to be. But Grolier Electronic Publishing Inc. has now gone online with the *entire* 21-volume (28,000 articles, 9 million words) hardcopy version of its *Academic American Encyclopedia*—making it the world's first unabridged online encyclopedia. Perhaps even more noteworthy, most users who have accessed the encyclopedia via either Dow Jones



Adams Averts "Baked Floppies"

Scott Adams, the 30-year-old programmer who runs an adventure-game empire from his geodesic-dome headquarters in Longwood, Florida, has finally convinced his wife that floppy disks taste terrible when served with meat loaf. "Back in 1978, when I first started spending so many hours at the computer, I came home from the office one night and my wife, Alexis, had put all my disks in the oven. It was a limited protest, though, because she hadn't turned the oven on. After a heart-to-heart talk she decided not to."

Alexis Adams, now vice-president of Adventure International, still gets a chuckle recalling how she nearly became the microcomputing world's first Julia Child. "Far from hating computers, she's as active in the business as I am," Scott allows. "It's hard to loathe computers when you see our three-year-old son learning My First Alphabet on the Atari."

Adams thinks the press is all wet when it equates "famous programmer" with "rock star." He's not hounded by groupies and never has to don sunglasses and a disguise to get to the supermarket. "The famous programmers are a lot like the science-fiction writers with reputations. It's a narrow sort of fame. Everyday life hasn't been interrupted at all."

But whether you call it fame or mild renown, that seed germinated back in 1978 when Adams decided to write a microcomputer version of a game called Adventure—then available only on mainframes. At home, Adams had a TRS-80 Model I with just 16K bytes of memory. "I told people what I planned to do and they could hardly stop laughing. They said it was impossible to do an adventure game with so little memory."

So Adams blithely tackled "the impossible." Despite the name Adventureland, his initial effort had nothing to do with splashy, Disneyesque graphics—it was a text-only fantasy.

Adams placed a few ads for Adventureland in BYTE magazine in 1979, and the response was so encouraging that he founded Adventure International in October of that year. It's now a multimillion-dollar outfit offering some 200 games and a wide selection of utility software and computer books.

And even though he must devote a portion of his day to business software, Adams still manages to break free and play computer games. His favorite non-Adams adventure games, incidentally, are Wizardry for the Apple II and Star Raiders for the Atari. □

News/Retrieval or BRS Inc. have found it to be genuinely useful.

The electronic encyclopedia was made available on Dow Jones after a rigorous videotex test phase in Columbus, Ohio. Since its inception, the success of the database has exceeded expectations, claims John Cole, vice-president of business development for Grolier. "The numbers are very high," says Cole, "in terms of Dow Jones's overall usage in that database compared to their other databases. The consumers seem to like the idea of having the encyclopedia available online and searchable (in Dow Jones's case) by subject and biographical name."

In March 1983, *Academic American* also went up on BRS (called Bibliographical Retrieval before it expanded its services), which provides information essentially to "professional searchers" in the library, school, and business markets. BRS offers what's called a full-text search. "You can choose any two words in the encyclopedia and the system finds every sentence that contains both words," Cole explains. "For example, say you're a student who wants to do a paper on Greek gods. You simply select the words 'Greek' and 'god,' followed by the search command. It's an amazing technical feat." (In other words, the system would stop at phrases such as "Greek wine god," which normal string searches would bypass.)

This summer, the encyclopedia is slated to be part of a three-county, southern Florida videotex service called Viewtron, a subsidiary of AT&T and the Knight-Ridder publishing organization. Viewtron wants to attract 5,000 subscribers by September. Grolier will put the encyclopedia online through what is called a "gateway," meaning it will be stored on computers in Philadelphia (along with the online version of Knight-Ridder's *Philadelphia Inquirer* newspaper) and will be hooked via telephone lines to the Viewtron computers.

Cole doesn't think that videotex—which is provided on the larger, more visually complete home TV screen rather than a small computer monitor—will spell doom for online services like BRS. "We haven't seen any marketing studies that indicate smaller screen size will be a limiting factor," he says. "One of the things we've been doing is monitoring the calls on the Dow Jones customer service line to see what kinds of complaints are coming in about the encyclopedia; essentially, there aren't any. Of course, there are all different screen and format sizes, and it takes four or five screens to show what a page in the encyclopedia would show, but that doesn't seem to be a problem. And encyclopedia customers are staying on Dow Jones for about seven minutes on the average, which is, to us, a long time."

But for an electronic encyclopedia to be an absolute reproduction of its hard-copy equivalent, Cole notes, the end user must be able to access photos, graphs, and charts—and that's where videodisc technology comes in. (Some encyclopedia publishers are already distributing their product in the form of videodiscs that can be played on either a standalone disc player or one controlled by a personal computer.) "We're very heavy into plans for videodiscs,' he confides, adding that Grolier's public announcement about specific videodisc projects will follow this summer. □

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Triple-Threat Printer

Letter-quality printing, rapid data copy, and high-resolution graphics are all features of Radio Shack's DMP-2100 printer.

Looking for a dot-matrix printer that can rival a daisy wheel's output? Radio Shack's DMP-2100 printer ($1995) combines letter-quality printing with a high-speed data-processing mode and high-resolution, dot-addressable graphics.

The key to the DMP-2100's versatile performance is a 24-wire print head that can print 32,400 dots per square inch, offering formed-letter quality in a single pass at 100 characters per second (774 words per minute). Print speed in the data-processing mode is 160 characters per second or 60 lines per minute at 132 columns. Additional print speeds at 10 characters per inch are 215 lines per minute at 20 columns, 151 lines per minute at 40 columns, and 93 lines per minute at 80 columns.

The DMP-2100 character set includes 96 ASCII (American National Standard Code for Information Interchange), 31 international, and 31 graphics characters. The printer supports boldface and underline functions and offers a variety of print styles including standard, condensed, high-resolution monospaced, and proportionally spaced correspondence characters. Matrix sizes include 36 by 24 for high-resolution monospaced and *n* by 24 for proportionally spaced characters.

Optional equipment for the DMP-2100 includes a bidirectional tractor for use with fanfold paper, labels, and forms ($169) and a sheet feeder for automatic paper insertion and stacking ($995).

The DMP-2100 is available from Radio Shack Computer Centers and participating Radio Shack stores and dealers. For details, contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

Circle 200 on inquiry card.

Expanding the IBM PC

IBM Personal Computer users interested in expanding their computer's capacity without filling up all of their system's expansion slots will want to look at Quadboard II, a plug-in board that provides six enhancements at once.

Quadboard II supplies the Personal Computer with two serial ports, a real-time clock, added memory, a RAM (random-access memory) disk, and a spooler, all compatible with existing system hardware. The

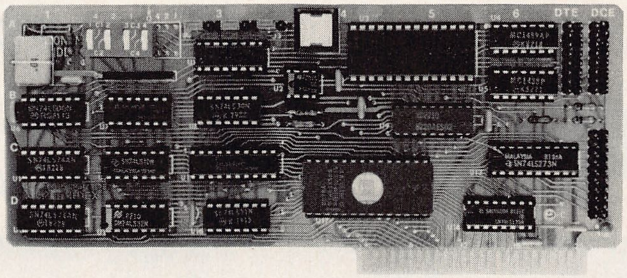
Two in One

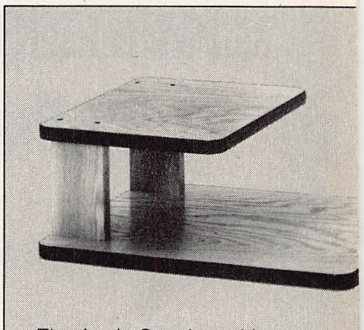
Videx's PSIO Dual Function Interface Card for the Apple II Plus and IIe allows both serial and parallel peripherals to be connected to the same expansion slot.

With PSIO, a printer and modem can be individually connected to and controlled from one board. PSIO is compatible with the Apple's BASIC or Pascal as well as CP/M. The board includes a nonvolatile random-access memory that records bits-per-second (bps) settings and features software-selectable configuration options.

The $229 PSIO board is available from Videx Inc., 897 Northwest Grant Ave., Corvallis, OR 97330.

Circle 201 on inquiry card.



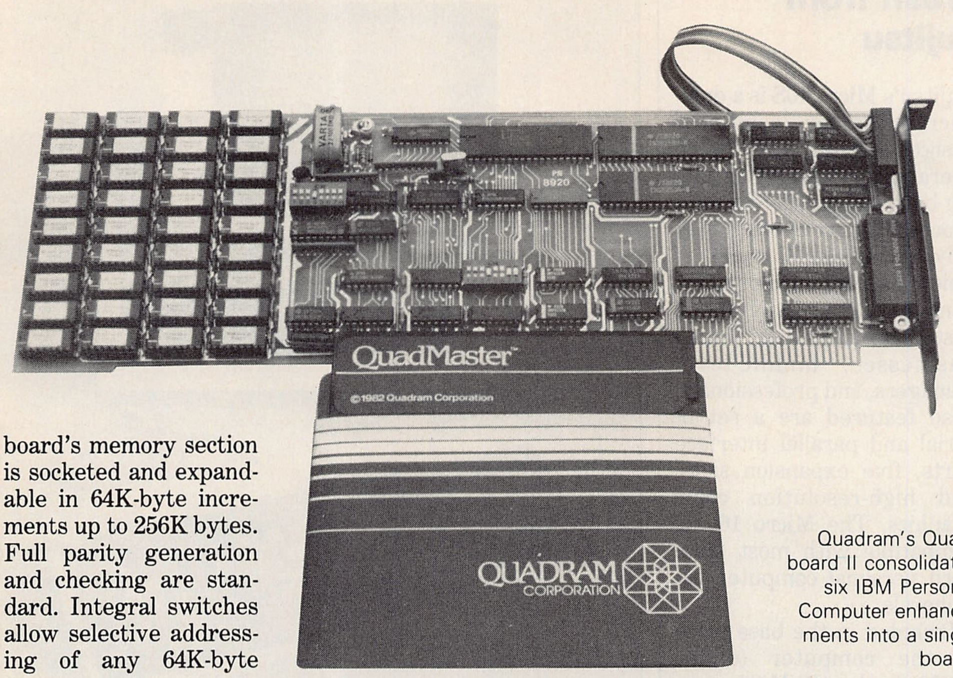


The Apple Stand provides a convenient home for your computer and peripherals.

Can You Stand Your Apple?

The Apple Stand is designed to end the annoying task of unstacking and disconnecting your disk drives and monitor every time you want to take a peek under the computer's hood. Cantilevered tiers support the shelves from the rear, eliminating the need for side supports that might hamper air flow.

The Apple Stand is offered



board's memory section is socketed and expandable in 64K-byte increments up to 256K bytes. Full parity generation and checking are standard. Integral switches allow selective addressing of any 64K-byte memory block. The Quadboard II package also includes a disk of Quadmaster software programs that simulate a floppy-disk drive in the board's memory, perform clock routines, and generate system diagnostic checks and other utilities.

Quadram's Quadboard II consolidates six IBM Personal Computer enhancements into a single board.

Quadboard II comes with a full one-year warranty and retails for $595 (64K-byte RAM), $775 (128K-byte RAM), $895 (192K-byte RAM), or $995 (256K-byte RAM). More detailed information may be obtained by writing Quadram Corporation, 4357 Park Dr., Norcross, GA 30093.

Circle 202 on inquiry card.

in two models: a two-tier stand that houses the computer and a monitor ($44.50) and a three-tier unit that also has room for a pair of disk drives ($54.50). Both versions are built of solid red oak and high-quality oak veneer plywood. The same manufacturer also offers printer stands and disk storage boxes in two sizes. For further information, contact The Walker Company, 1801 Pepper Rd., Petaluma, CA 94952.

Circle 203 on inquiry card.

Portable Access

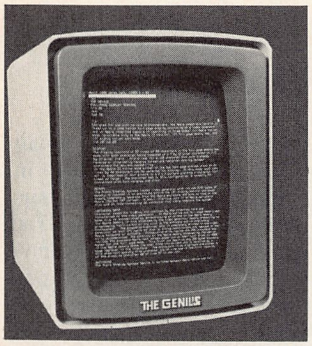
Access is a portable computer system with all peripherals integrated into a compact unit. Designed for business, educational, professional, and home use, the computer boasts 64K bytes of random-access memory and five microprocessors, including a central Z80A.

Retailing for $2495, Access includes a high-speed dot-matrix printer, a 7-inch amber monitor, two 5¼-inch disk drives, an acoustic modem, a detachable keyboard, multiple I/O ports, a storage compartment for 10 disks, and a leather carrying case. Access's accompanying software package includes a word processor, a spelling checker, an electronic spreadsheet, and a database system. The computer comes with the CP/M 2.2 operating system.

Further information is available from Access Matrix Corporation, 2159 Bering Dr., San Jose, CA 95131.

Circle 204 on inquiry card.

Access
Access



Playing with a Full Page

Any computer with an RS-232C serial interface can now have a text display of 57 lines by 80 characters thanks to The Genius, a full-page display system.

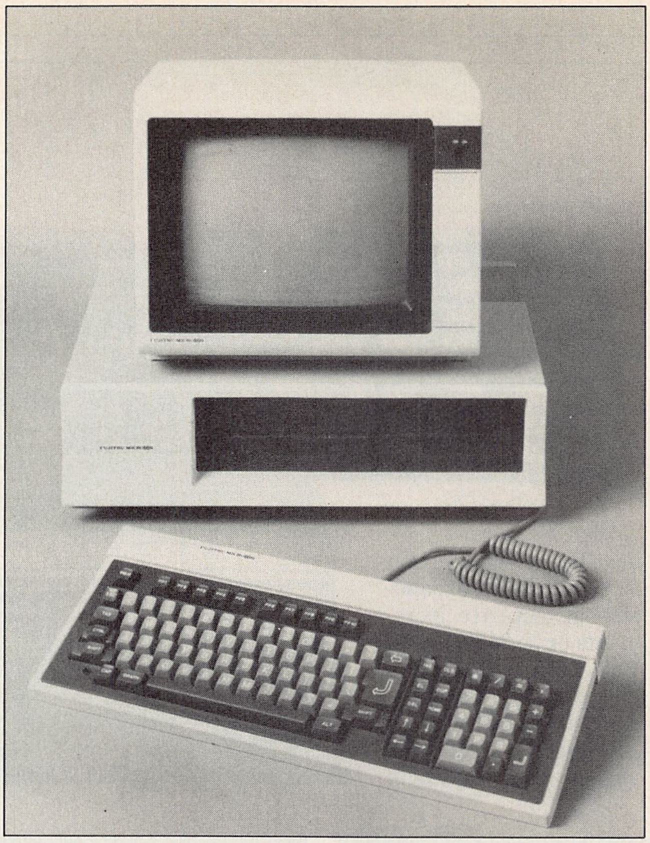
Aimed at users of word-processing, financial-modeling, and software development programs, The Genius display is available with white, green, or amber phosphors and is capable of displaying reverse and flashing video. The 8- by 10½-inch display utilizes a 128-character ASCII (American National Standard Code for Information Interchange) character generator with German, French, and international European sets available as options. Characters are formed on a 7 by 12 or 9 by 12 dot matrix for easy reading.

The Genius's RS-232C interface functions at speeds up to 19,200 bits per second with all of its functions controlled by a Z80 microprocessor. An internal memory of 16K bytes provides buffering and internal screen memory. The Genius sells for $1795. The Genius is also available in an Apple II-compatible package complete with its own interface.

More information is available from Micro Display Systems Inc., POB 455, Hastings, MN 55033.

Circle 205 on inquiry card.

Fresh from Fujitsu



Fujitsu's Micro 16S — two "brains" are better than one.

Fujitsu's Micro 16S is a dual-microprocessor computer designed to run the CP/M-86 operating system. Containing both Z80 and 8088 microprocessors, two 5¼-inch disk drives, and 128K bytes of random-access memory (expandable to 1 megabyte), the system is aimed at small businesses, middle-level managers, and professionals. Also featured are a set of serial and parallel interface ports, five expansion slots, and high-resolution color graphics. The Micro 16S is compatible with most standard personal computer peripherals.

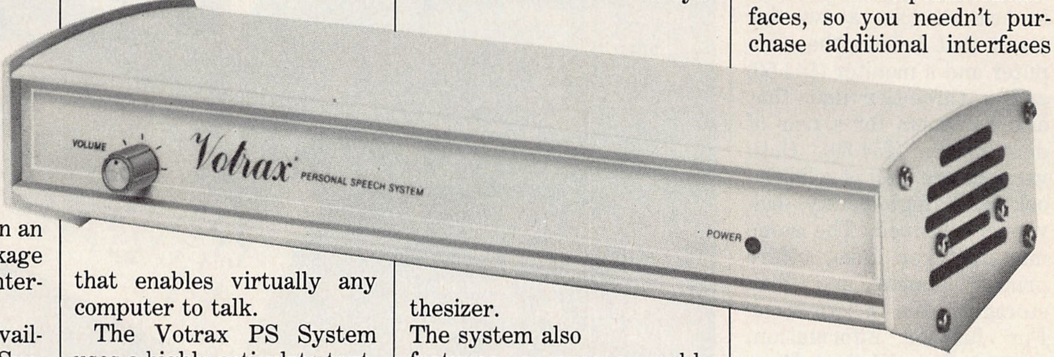
Included in the base price of the computer (under $4000) is the CP/M-86 operating system, word-processing software, and an electronic spreadsheet package. The Micro 16S can be linked to Corvus Systems' Omninet communications network and serve as an intelligent node in a larger network, sharing resources and programs with other machines. An optional 10-megabyte hard-disk system ($2000) can be inserted into a drive slot to provide users with extra storage capacity.

Additional information is available from Fujitsu Professional Microsystems Division, 2985 Kifer Rd., Santa Clara, CA 95051.

Circle 206 on inquiry card.

Personal Speech System

The Votrax Division of Federal Screw Works has introduced the Votrax Personal Speech System, a peripheral that enables virtually any computer to talk.



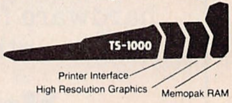
The Votrax PS System uses a highly articulate text-to-speech translator and thus achieves a translation accuracy rate of at least 95 percent for conversational vocabulary. Its speech is substantially more intelligible than any previously available in a low-cost synthesizer.

The system also features a programmable master clock, 350 programmable frequencies for speech and sound effects, and a built-in speaker that can simultaneously provide speech and sound effects or speech and music.

The $550 Votrax PS System comes equipped with both serial and parallel interfaces, so you needn't purchase additional interfaces to connect it to a computer. User-programmable speech rate and amplitude give you

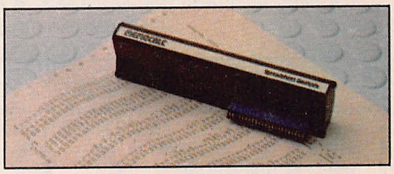
TIMEX MAKES THE COMPUTER, BUT WE MAKE IT TICK.

If you own a TS-1000 or ZX-81 computer and want to bring out the power within it, you'll want Memotech. From easier input to high quality output and greater memory, Memotech makes the add-ons you demand. Every Memotech peripheral comes in a black anodized aluminum case and is designed to fit together in "piggy back" fashion enabling you to continue to add on and still keep an integrated system look.

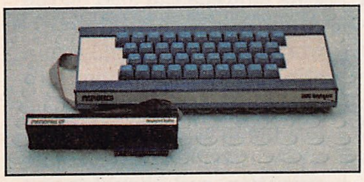


MEMOPAK 64K
MEMOPAK 32K
MEMOPAK 16K

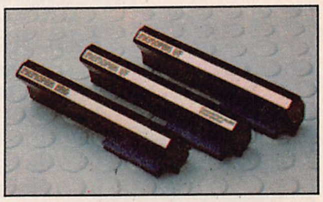
MEMOPAK RAM All Memopak RAMs are directly addressable, user transparent, are neither switched nor paged and no additional power supply is required. You can also choose the Memopak RAM which is just right for your needs. From economy to power. **16K RAM** The Memopak 16K RAM is the most economical way to add memory to your TS-1000. It is fully compatible with the Timex or Memotech 16K RAMs to provide you with up to 32K of RAM. The 16K RAM also offers additional add-on capabilities through its "piggy back" connection. **32K RAM** The 322K Memopak enables you to execute sophisticated programs and store large data bases and like the 16K RAM is fully compatible with Timex's or Memotech's 16K RAMs to give you a full 48K of RAM. **64K RAM** The 64K Memopak is powerful enough to turn your TS-1000 into a computer with capabilities suitable for business and educational use. It accepts such BASIC commands as 10 DIM A (9000). **MEMOCALC** Memocalc, our spreadsheet analysis software, enables TS-1000 users to perform complex number crunching routines with ease. With the 64K RAM a table of up to 7000 numbers with up to 250 rows or 99 columns can be specified. Quick revisions can be achieved by entering new data to your formula.



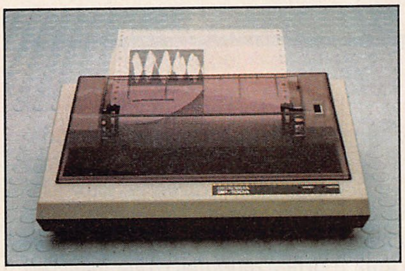
MEMOTECH KEYBOARD For ease of operation, the Memotech keyboard is a high quality standard typewriter keyboard, with TS-1000 legends. The keyboard is cable connected to a buffered interface which is housed in a standard Memopak case and plugs directly into the back of the TS-1000 or other Memopaks. **MEMOPAK HRG** The Memopak High Resolution Graphics, with up to 192 by 248 pixel resolution, enables display of high resolution "arcade game" style graphics through its resident 2K EPROM, programmed with a full range of graphics subroutines.



CENTRONICS PARALLEL AND RS232 INTERFACES Memotech's Interfaces enable your TS-1000 to use a wide range of compatible printers. The resident software in the units gives the complete ASCII set of characters. Both Memopak Interfaces provide lower case character capabilities and up to 80 column printing. The RS232 Interface is also compatible with modems and terminals.



SEIKOSHA GP 100A PRINTER The Seikosha GP 100A uses a 5x7 dot matrix printing format with ASCII standard upper and lower case character set. Printing speed is 30 characters/second with a maximum width of 80 characters. The printer uses standard fanfold paper up to 9-1/2 inches wide. The GP 100A is offered as a package including cable and interface. Other printer packages are also available through Memotech.



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Mail To: Memotech Corporation, 7550 West Yale Ave., Denver, CO 80227
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64K RAM	149.95		
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Tax (Colorado residents only)			
TOTAL			$

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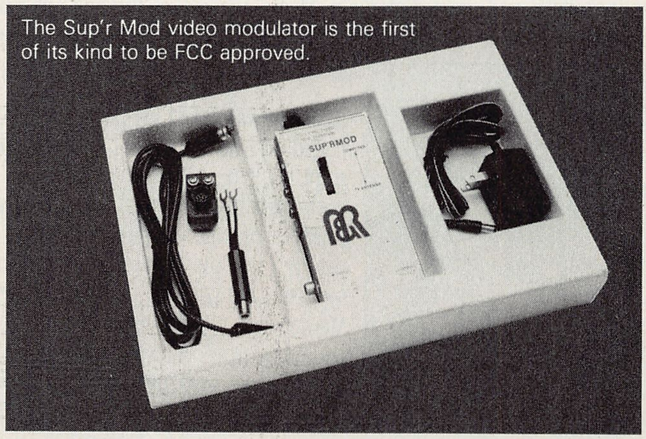
a more natural rhythm and greater control over word emphasis. The system also includes a real-time clock that can activate an audible alarm, a chime-prompted mode, oral error prompting, and a commonly used communications protocol.

Further details are available from the Consumer Products Group Manager, Votrax Division of Federal Screw Works, 500 Stephenson Hwy., Troy, MI 48084.

Circle 207 on inquiry card.


The Sup'r Mod video modulator is the first of its kind to be FCC approved.

Modulator with Federal Approval

M&R Enterprises has introduced the first video modulator approved by the Federal Communications Commission (FCC) for use with home computers. The Sup'r Mod module, which connects any computer with NTSC composite video output to an ordinary color or black-and-white TV, was developed to meet last year's new FCC regulations.

The new modulator, unlike others on the market, draws its power from a small transformer that plugs into a standard AC power outlet. This lightens the load on the computer's often overworked power supply and eliminates the need to modify the computer. The $70 modulator also includes a power regulator for stable operation and should cause virtually no TV or radio interference.

Write M&R Enterprises, 910 George St., Santa Clara, CA 95050, for more details.

Circle 208 on inquiry card.

Polly Want a Computer?

The Parrot plug-in speech module for Timex/Sinclair computers is easy to use and can generate all 64 allophones (discrete sounds) of spoken English. By arranging these sounds in different patterns with the system's accompanying software, you can generate a wide array of words, phrases, and sounds.

Priced at $69.95, the Parrot plugs directly into the computer's expansion slot and is designed to allow other modules to be inserted behind it. Further details are available from R.I.S.T. Inc., 921 Port Washington Blvd., Port Washington, NY 11050.

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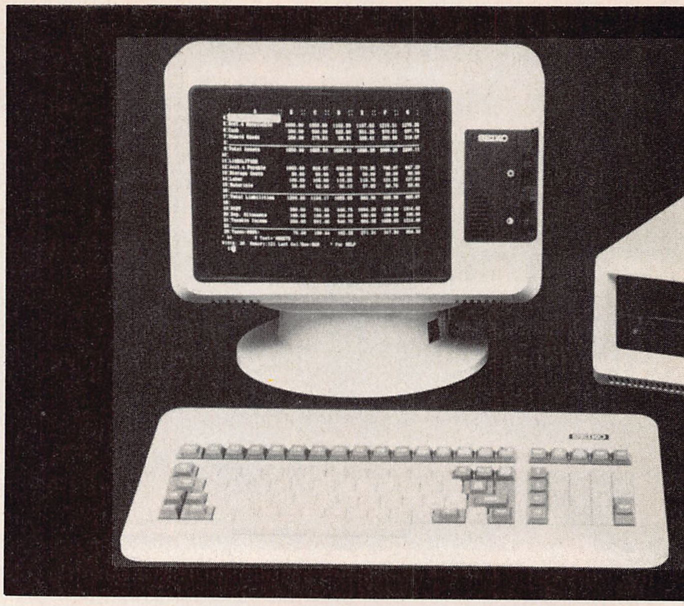
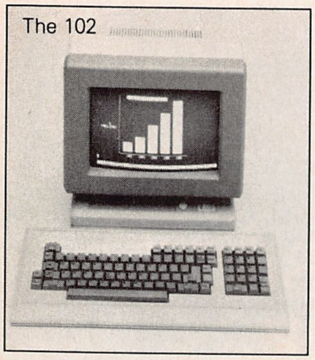
Seiko Series 8600 Multiuser Micro

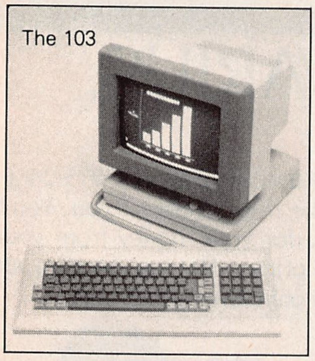
The Seiko Series 8600 multiuser desktop computer is a 16-bit, 8086-based unit that offers up to 512K bytes of RAM (random-access memory), two 5¼-inch floppy-disk drives, four serial ports, one parallel port, and options such as a 10-megabyte hard-disk drive and from one to four intelligent display terminals. The system supports six operating systems and six languages.

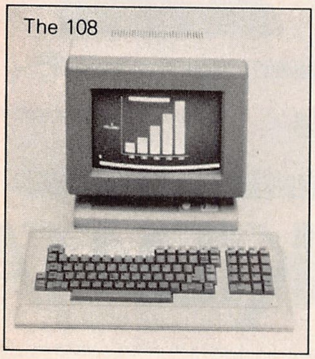
Designed for maximum user comfort, the Series 8600 includes a swiveling 12-inch green-phosphor display screen and a 100-key detachable keyboard with tilt adjustment and a 6-foot coiled cable. The system also offers extensive built-in diagnostics on the microprocessor, displays, and disk controllers. A typical single-user installation costs $5400; three-user system prices begin at $9000.

More information is available from Sci-Com Computer Systems, POB 6050, Bridgewater, NJ 08807.
Circle 210 on inquiry card.




The 102


The 103


The 108

Qume's Terminal Trio

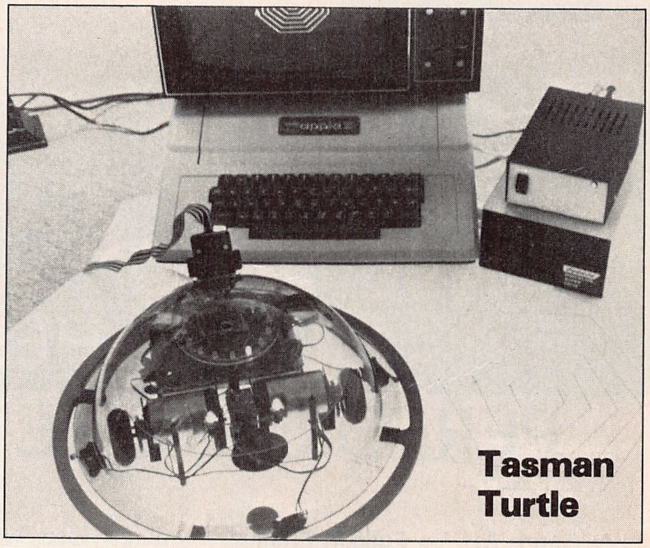
Qume has introduced a new line of three cathode-ray tube (CRT) terminals designated as the 102, 103, and 108.

Each terminal includes a tilting and swiveling 12-inch display screen and a low-profile, detachable keyboard. Other standard features are a nonglare green-phosphor screen, a menu set-up mode, a 9 by 12 character matrix, four programmable function keys, a self-test system, block transfers for both line and page, a line-drawing character set, and a power supply that consumes only half the energy of most competitive terminals.

The 103 also offers two pages of memory, a split-screen option, 80- or 132-character display formats, and smooth scrolling. The 108 has 11 programmable function keys (22 with shift) and a clock.

The 102 has a suggested retail price of $695; the 103 and 108 both list for $895. Contact Qume Corporation, 2350 Qume Dr., San Jose, CA 95131.
Circle 211 on inquiry card.

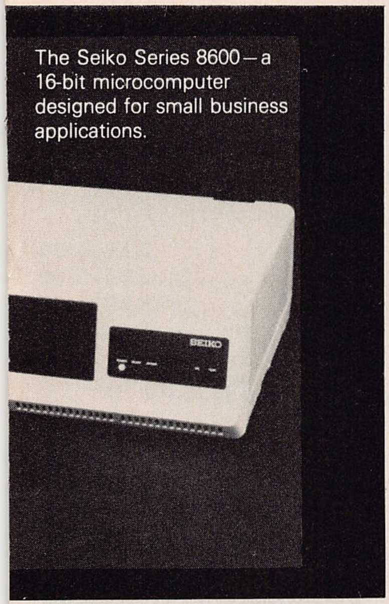
Tasman Turtle


The Tasman Turtle—an Aussie turtle that talks with a Yank accent.

Australia's Flexible Systems has introduced a turtle robot that can move, talk, draw with a pen, and "feel" through built-in touch sensors. Besides being a lot of fun to program and watch, the Tasman Turtle allows young children to develop computer awareness and basic programming concepts, draw geometric designs, and learn elements of mathematics and artificial intelligence. More experienced programmers can use BASIC, Logo, or other high-level languages to put the turtle through its paces.

The Tasman Turtle is equipped with a 150-word basic vocabulary (with American speech inflections) that may be expanded to more than 600 words. Other features include an electronic compass, a horn, and blinking eyes. The unit will connect to any microcomputer with a parallel or serial port. System prices start at $995.95; contact Harvard Associates Inc., 260 Beacon St., Somerville, MA 02143, for further details.
Circle 212 on inquiry card.

Circle 11 on inquiry card.



The Seiko Series 8600—a 16-bit microcomputer designed for small business applications.

Computer on a Drive

The Micro Mainframe disk drive for Atari computers is more than just another external storage device. Inside the unit is a Z80A microprocessor with 16K bytes of random-access memory. With additional hardware from the manufacturer, the drive can be expanded to a full-fledged 64K-byte Z80 computer system using the Atari as its terminal for inputting keyboard commands and displaying program results.

Retailing for $450, the drive is available in either 5¼- or 8-inch formats and can run most Z80-based operating systems, including CP/M and Radio Shack's TRSDOS. When operating under TRSDOS, the drive may be configured to emulate a TRS-80 Model I, II, or III computer. A Centronics-compatible printer port allows Atari users to connect most popular printers to their computers.

For additional information, including prices of upgrade kits, contact Micro Mainframe, 2227 McGregor Ave., Rancho Cordova, CA 95670.
Circle 213 on inquiry card.

Texas Toddler

Baby Tex, a coprocessor board that allows the Texas Instruments Professional Computer to run CP/M software, is the latest offering from Xedex. Using the TI Professional Computer's standard MS-DOS, Baby Tex eliminates the need for a separate CP/M operating system.

Besides allowing its users to take advantage of thousands of CP/M programs, Baby Tex also enables Professional Computer owners to transfer files with nine other popular microcomputers. To promote rapid and efficient operation, a special utility offers a simple way to set function keys for any CP/M program.

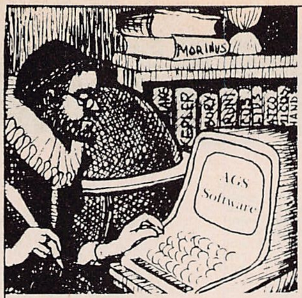
Baby Tex includes 64K bytes of additional system memory accessible even when the coprocessor unit is not in use. More details on the $600 system are available from Xedex Corporation, 222 Route 59, Suffern, NY 10901.
Circle 214 on inquiry card.

Easy Reference

Tired of searching for information about your Sinclair ZX80, ZX81, or Timex/Sinclair 1000? The Sinclair System Reference Card ($5.95) from Nanos Systems has complete information for each of these computers on one 10-panel, 20-page card.

Each accordion-style folding card presents information on BASIC statements and commands, intrinsic and derived functions, special characters and operators, screen layout, read-only memory (ROM) subroutines, error codes, hexadecimal/decimal conversion, Z80 timing, operation codes, condition codes, and system memory maps.

Contact Nanos Systems Corporation, POB 24344, Speedway, IN 46224.
Circle 215 on inquiry card.



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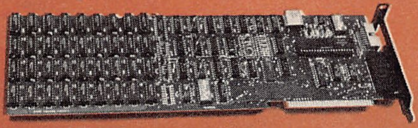

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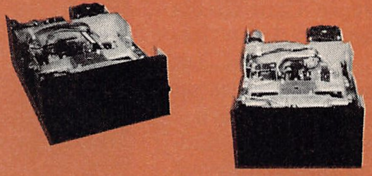

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TM-100-1 SS/DD	**$189.00**
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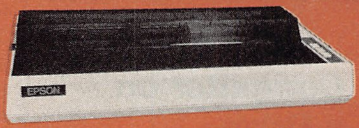
PRINTERS



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FX-80 FT w/Graftrax Plus	**$599**
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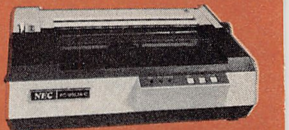

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7710-1	**$1995**	3510	**$1395**
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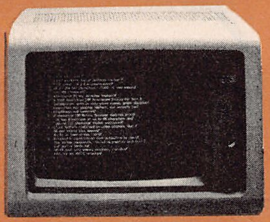

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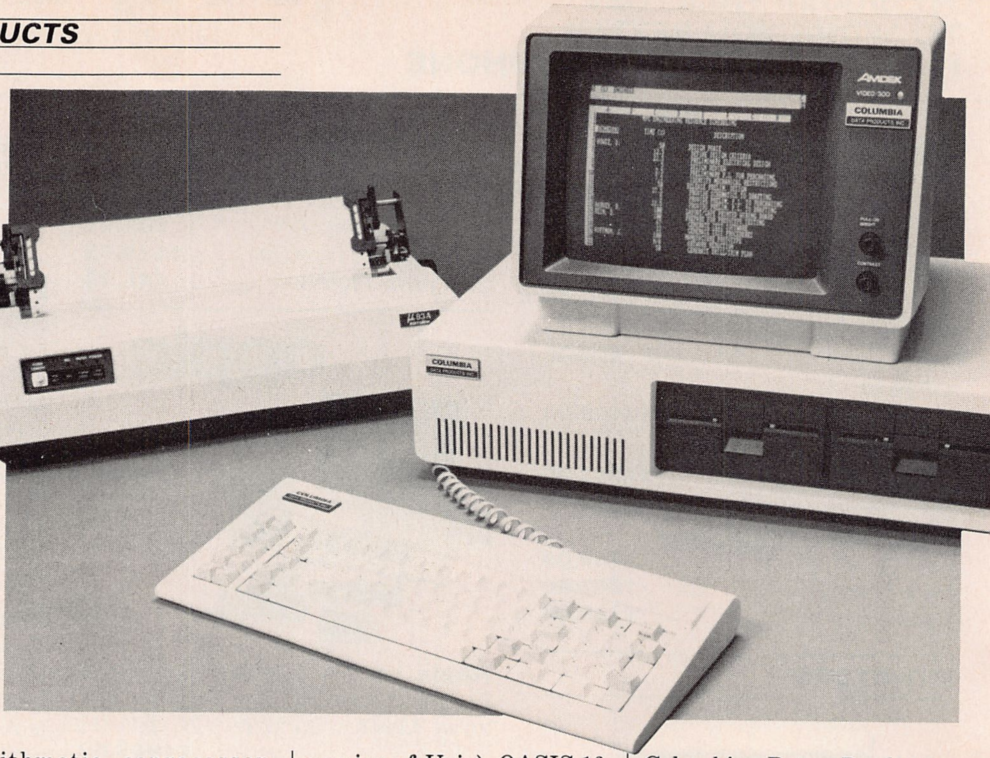


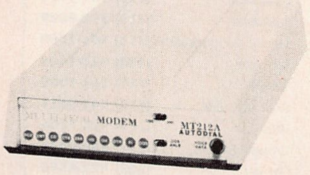
Columbia Data Products' Multi-Personal Computer is a 16-bit, 8088-based microcomputer that covers a wide range of multiuser and multitasking applications while offering IBM Personal Computer compatibility on all levels of operation.

In its $4000 configuration, the computer features 128K bytes of random-access memory, one parallel and two serial ports, a detachable keyboard, dual disk drives, a color-graphics video adapter, a 12-inch green-phosphor monitor, MS-DOS and CP/M-86 operating systems, BASIC, and a macro assembler. Optional items include Z80 and 68000 microprocessor boards, a hard-disk drive, and an 8087 arithmetic coprocessor. Available operating systems and languages include MP/M-86, Xenix (Microsoft's version of Unix), OASIS-16, Fortran, COBOL, Pascal, and C.

For more details, contact Columbia Data Products, 8990 Route 108, Columbia, MD 21045.
Circle 216 on inquiry card.

Automatic-Dialing Modem

Multi-Tech Systems' new MT212A Autodial is a Bell-212A-compatible modem for full-duplex operation at both 300 and 1200 bits per second (bps).

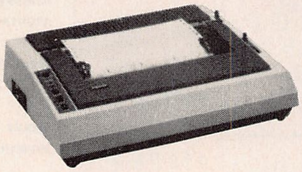


The unit dials stored numbers with a single keystroke, displays system status on the screen, and accommodates pulse or tone dialing.

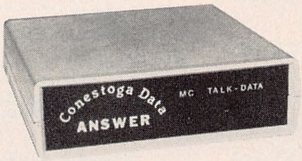
The MT212A Autodial is available in both stand-alone ($795) and rack-mounted ($620) versions. Contact Multi-Tech Systems Inc., 82 Second Ave. SE, New Brighton, MN 55112.
Circle 217 on inquiry card.

The Facets of Facit

Designed for use in small businesses, the Facit/Dataroyal 4510 dot-matrix printer offers as standard features three paper-handling modes, a multifont capability, a 2K-byte buffer, parallel and serial interfaces, block- and pin-addressable graphics, an operator-replaceable print head, and 120-character-per-second bidirectional printing with three different pitch settings or proportional spacing.



For more details on the $695 printer, contact Facit Inc., 235 Main Dunstable Rd., Nashua, NH 03061.
Circle 218 on inquiry card.



But What's the Question?

The Answer is an inexpensive ($69.95) method of adding automatic-answering capabilities to any 300-bit-per-second (bps) manual modem. The Answer responds to incoming calls, maintains the connection as long as a signal is present on the line, and terminates the call.

The Answer allows normal telephone operation with either acoustic or direct-connect configurations, signals incoming calls, and gives instant confirmation of communications.

Contact Conestoga Data Inc., 8403 121st Place N, Largo, FL 33543.
Circle 219 on inquiry card.

Computerizing the Home

Circuit Science Inc. has introduced a low-cost electric-circuit remote-control unit that interfaces with most RS-232C computers.

SYSTEM 1200
CIRCUIT SCIENCE INC.
CSI

The CSI-1200 Electric Appliance Controller lets you control up to 256 switches through BASIC commands. The system operates in conjunction with BSR-X10 remote modules. The CSI-1200 costs $169.

Write Circuit Science Inc., Four Townsend West #3, Nashua, NH 03063.
Circle 220 on inquiry card.

The new COMPAQ Portable Computer. IBM compatibility to go.

Simple, isn't it? The COMPAQ™ Portable Computer can do what the IBM® Personal Computer does. To go.

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If you use a portable typewriter, you can use the COMPAQ Computer as a portable word processor instead.

If your company already uses the IBM Personal Computer, add the COMPAQ Portable as a mobile unit that can use the same programs, the same data disks, and even the same user manuals.

There are more programs available for the COMPAQ Computer than for any other portable. More, in fact, than for most non-portables. You can buy them in hundreds of computer stores nationwide, and they run as is, right off the shelf.

With most other portables you'd probably need to buy an additional display screen because the built-in screen is too small for certain tasks, like word processing. The COMPAQ Computer's display screen is nine inches diagonally, big enough for any job, and it shows a full 80 characters across. And the built-in display offers high-resolution graphics and text characters on the same screen.

The bottom line is this. The COMPAQ Computer is the first uncompromising portable computer. It delivers all the advantages of portability without trading off any computing power capability.

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The COMPAQ Portable sells for hundreds less than a comparably equipped IBM or APPLE® III. Standard features include 128K bytes of internal memory and a 320K-byte disk drive, both of which are extra-cost options on the IBM. Memory and additional disk drive upgrades are available options to double those capacities.

In the standard configuration, the COMPAQ Computer has three open slots for functional expansion electronics as your needs and applications grow. It accepts standard network and communications interfaces including ETHERNET™ and OMNINET™.

If you're considering a personal computer, there's a new question you need to ask yourself. Why buy a computer that *isn't* portable?

For more information on the COMPAQ Portable Computer and the location of the Authorized Dealer nearest you, write us. COMPAQ Computer Corporation, 20333 FM149, Houston, Texas 77070. Or call 1-800-231-9966.

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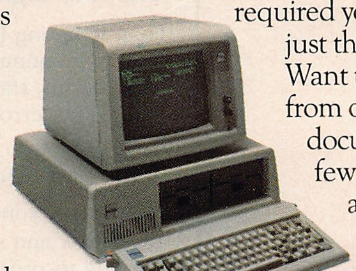

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You gain an intimate knowledge of your computer's resident Applesoft, as well as more advanced versions of BASIC. And who knows, HANDS ON ASSEMBLY PROGRAMMING may soon enter your life.

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EDUWARE

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Business

The Auctioneer—A program that provides bookkeeping functions for auctioneers. This package registers bidders and presents an auction summary by calculating gross sales, commissions, sales tax, and consignor net check amounts. For the **Osborne 1**; $600. CE Software, 801 73rd St., Des Moines, IA 50312.

Compupeg—A health-care accounting system that can accommodate a four-doctor practice. Features include receivables, account aging, monthly service charges, insurance forms, patient recall, and ledger accounting. This program can handle up to 30,000 patient accounts. For **CP/M-based** systems with 64K bytes of memory; $700. Compupeg Software Specialists, 1202 West Ridgeway, Waterloo, IA 50701.

Datagraph—An updated version of Visicorp's **Visigraph** program that lets you graph information from **Visicalc** and plot it in a variety of formats. You can specify the exact figures you want plotted from each spreadsheet. For the Radio Shack **TRS-80 Models I** and **III** with 48K bytes of memory and **Epson, NEC, C.Itoh, IDS, Okidata,** or Radio Shack **VIII/DMP-200** printers; $79.95. Colorplot version for IDS **Prism** printers, $89.95. Micro Software Systems, 1815 Smokewood Ave., Fullerton, CA 92631.

The Final Analysis—A cost-management program for business executives who want to exercise better control over company expenses. This system calculates costs for the company's products or services and provides answers to "what if" questions. Requires an 80-column printer and two disk drives. For the **Apple II Plus** with 64K bytes of memory, the **Apple III** with 128K bytes of memory, and the Franklin **Ace 1000**; $275. Silicon Valley Systems Inc., Suite 4, 1625 El Camino Real, Belmont, CA 94002.

Jack—A package that features four applications: personal filer, calc package, word processing, and mailing-list management—all of which are executed with a simple integrated set of commands. Files are user-defined, and up to 1000 records can be stored on a single disk. For the **Apple II** with 64K bytes of memory and two disk drives and the **Apple IIe** with an 80-column board and two disk drives; $129. Business Solutions Inc., 60 East Main St., Kings Park, NY 11754.

Label Maker—A program that produces customized mailing labels in a variety of formats. For the Radio Shack **TRS-80 Models I** and **III**; floppy disk or cassette, $15 and $10, respectively. Practical Programs, 1104 Aspen Dr., Toms River, NJ 08753.

Mailing List Manager—A program that tracks and maintains a centralized mailing list that can be printed in either roster-list format or as standard mailing labels. For the **SOL-20**, **North Star**, and **S-100-based** computers; $34.95. Minnetonka Software, POB 392, Paramus, NJ 07652.

MicroCAD—A new version of a computer-aided design (CAD) program that lets you draft and edit three-dimensional images. This program handles circles, arcs, and other geometrical figures and can plot up to 4000 points. For the **IBM Personal Computer**; $500. Computer Aided Design, 764 24th Ave., San Francisco, CA 94121.

PFS:File—A user-designed filing system that lets you record, file, retrieve, and summarize information with a fill-in-the-blank format. Files can be sorted and merged, and form designs can be changed without having to reenter data. For the **IBM Personal Computer**; $140. Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94043.

Powerbase—A database-manager for executives with no previous programming experience. Powerbase features include fast search, sort, and select functions, as well as a special search key for "sounds like" retrieval. It handles arithmetic expressions written in algebraic form and will automatically recalculate derived data fields whenever a field is changed. For the **IBM Personal Computer** with 128K bytes of memory, PC-DOS, and two 160K-byte floppy-disk drives; $475. GMS Systems Inc., 12 West 37th St., New York, NY 10018.

Softax—A tax package for use with Visicorp's **Visicalc** that helps you simulate different tax strategies. Information for tax models can be entered in summary form or in detail using actual tax forms and schedules. Output is complete and may be submitted directly to the Internal Revenue Service. For personal or professional use. Requires **Visicalc**. For the **IBM Personal Computer** and the **Apple II Plus** and **Apple III**; $395. Design Trends Ltd., POB G, Wilton, CT 06897.

Visibridge/Sort—A program designed to sort rows or columns in a **Visicalc** spreadsheet. Up to five rows or columns may be sorted with alphabetic or numeric keys. This program works with all current versions of Visicorp's **Visicalc**. For the **Apple II Plus, Apple III, IBM Personal Computer,** Radio Shack **TRS-80 Models I, II, III,** and **16**; $89. Solutions Inc., POB 989, Montpelier, VT 05602.

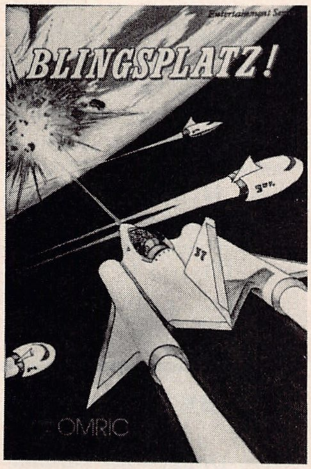
Games

Astro-Dodge—An arcade-type game that features high-resolution color graphics. The object is to score points by destroying meteoroids and ships, while avoiding the enemy's attack. For the **IBM Personal Computer** with 64K bytes of memory and a color graphics board; $39.95. Digital Marketing Corp., 2670 Cherry Lane, Walnut Creek, CA 94596.

New Software provides up-to-date listings of the latest releases in microcomputer software, grouped into seven categories: Business, Games, Home, Education, Programming Languages, Word Processing, and Technical Tools. New Software listings are based on product information supplied by the manufacturers and should not be considered endorsements of the products listed. For in-depth evaluations of the most important and interesting new releases, read our Software Review section.

NEW SOFTWARE

Blingsplatz—An arcade-type game that takes place in outer space. Your outposts are being attacked by Blingsplatz creatures and you must defend yourself with missiles. As the game progresses, the attacks come more rapidly. For the **IBM Personal Computer** with 64K bytes of memory; $34.95. Omric Corp., 258 Tower Hill Rd., POB 309, Chaplin, CT 06235.



Bomb Alley—A simulation of the summer 1942 Mediterranean campaign that centered around the island of Malta and involved more than 300 warships. Statistics on each ship give you the necessary information to make crucial decisions. For the **Apple II** with Applesoft ROM card and the **Apple II Plus** and **Apple III**; $59.95. Strategic Simulations Inc., Suite 108, 465 Fairchild Dr., Mountain View, CA 94043.

Boulders and Bombs—An arcade-type game that sends you on a mission beneath the surface of an unknown planet. Along the way, alien vultures attempt to foil your plans—but you can fight back with time bombs. For the **Atari 400** and **800**; $39.95. CBS Software, One Fawcett Place, Greenwich, CT 06830.

Crosswords—A Scrabble-type game in which players create words from a group of randomly selected letters and position them in a designated area to form a crossword puzzle pattern. For the **TRS-80 Color Computer**; cartridge, $24.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

Cyberchess—An electronic chess game designed to increase your playing skill by providing an in-depth analysis of each move. Cyberchess is available in packs containing four analyzed games. Levels range from amateur to master. For the Radio Shack **TRS-80 Models I** and **III**; analyzed game packs, $29.95. Additional four-game packs, $19.95. IJG Inc., 1953 West 11th St., Upland, CA 91786.

Federation—An arcade-type game. As commander of a Federation starship, you must defend the mining colony on Deneb VII by obliterating the attacking Drorn Drones. For the **IBM Personal Computer** with color graphics board; $29.95. Avant-Garde Creations, POB 30160, Eugene, OR 97403.

Gamemaster—A character-generating and record-keeping program for role-playing fantasy/adventure games. You create different characters, settings, and situations and store them for future use. The program is compatible with Dungeons and Dragons and similar games. For the **Timex/Sinclair 1000** and **ZX81** computers with 16K bytes of memory; cassette, $14.95. McKelvie Programs, POB 53076, Philadelphia, PA 19105.

Legacy of Llylgamyn—An adventure game. To save the kingdom of Llylgamyn from the forces of nature, the wizards and sages send you on a mission to recover the mystical orb from the evil dragon, L'kbreth. For the **Apple II, II Plus, III,** and **IIe**; $39.95. Sir-Tech Software Inc., 6 Main St., Ogdensburg, NY 13669.

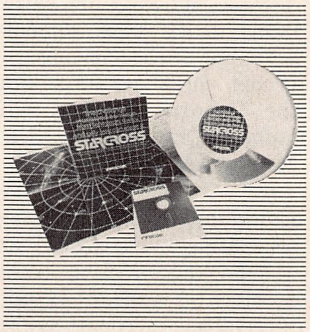
Revolution—A game that simulates the sport of race-car driving. This menu-driven program allows you to choose the car and track you want to race on, then saves your lap records when you're finished. Requires a joystick. For the Radio Shack **Color Computer** and the **TDP-100**; floppy disk or cassette, $24.95 and $22.95, respectively. Inter+Action, 113 Ward St., New Haven, CT 06519.

Sky Blazer—Originally released as **Star Blazer**. Your assignment is to clear away enemy radar and missile installations. Avoid heat-seeking missiles, explosive balloons, and jets while trying to destroy supersonic tanks and refuel. For the **Atari 400** and **800** with 48K bytes of memory; $31.95. Broderbund Software, 1938 Fourth St., San Rafael, CA 94901.

Space Bowl—A combination space and sports game featuring an extraterrestrial sporting event in black space. Goals orbit the field making it more difficult to score. You can score by putting the ball in the opposing team's goal or by zapping the opposing players. For the **Atari 400** and **800** with 16K bytes of memory; floppy disk or cassette, $29.95. Gamma Software, POB 25625, Los Angeles, CA 90025.

Space Race—Maneuver your spaceship around the four-cornered racetrack scoring points by destroying the fleets of Collectors, Swarmers, and Berserkers. Avoid the mines laid by the Swarmers. For the **TRS-80, TDP-100,** and **Dragon Data Color Computer** with 16K bytes of memory; $21.95. Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466.

Starcross—A science fiction adventure game that takes place in the 22nd century. In your adventures, you'll meet a spaceship from the outer edge of the galaxy and encounter both good and evil aliens. For the **Apple II, Atari 400** and **800, TRS-80 Models I** and **III**; $39.95. Also for the **NEC-8000, APC, PDP-11,** and **CP/M-based** systems; $49.95. Infocom Inc., 55 Wheeler St., Cambridge, MA 02138.



Star Search—Each player in this adventure game is the captain of her or his own spaceship. You must decide which crew members, supplies, and tools to select for the mission. It is up to the captain to locate the origin of a radio signal believed to becoming from Epsilon Eridani. Players that make the most of their resources win the game. Games may be saved and continued later. An educational version is available for schools. For the **Apple II** with 48K bytes of memory; $45. Earthware Computer Services, POB 30039, Eugene, OR 97403.

Home

Dietcalc—A personalized diet-maintenance program that analyzes information you provide about your living and eating habits. It will calculate the number of calories you need to consume in order to lose or maintain your weight. You can also see the effects of different types of exercise. For the **Apple II** and the **IBM Personal Computer**; $24. Savant Software, POB 440278, Houston, TX 77244.

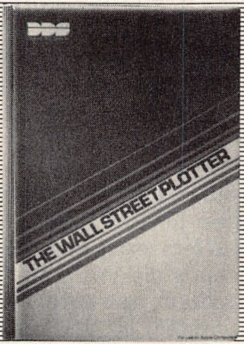
Electronic Scratch Pad—A program designed for people who want to keep track of items and related costs such as tax deductions, collectibles, software, magazines, etc. This menu-driven system can also be used as a mini word processor for simple editing. For the Radio Shack **TRS-80 Models I and III**; floppy disk or cassette, $20 and $15, respectively. Practical Programs, 1104 Aspen Dr., Toms River, NJ 08753.

FCM—Formerly called First Class Mail, this database manager has the ability to print envelopes with return addresses and messages. It can function as a user-defined inventory system for personal records. A form-letter enhancement is available that will support word-processing programs. For the **Apple II**, $99.95; (complete package); and the **IBM Personal Computer**, $124.95. Continental Software, 11223 South Hindry Ave., Los Angeles, CA 90045.

The GraphVIC Tablet—A drawing program that lets you create your own pictures on the screen with the use of your keyboard or joystick. Features include changeable colors for the screen, border, and characters and computer-drawn circles and lines. For the Commodore **VIC-20** with Super Expander cartridge; cassette, $25. Tri-Cities Computer Service, POB 205, Latham, NY 12110.

Personafile—A personal record-keeping system for storing and retrieving such information as addresses and telephone numbers, household inventories, and other lists. Personafile stores more than 500 user-defined records in over 250 different categories. For the **TRS-80 Color Computer** with Extended BASIC and a disk drive; $59.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

The Wall Street Plotter—A program for individual investors that provides visual tools for technical analysis of financial securities, commodities, and market averages. For the **Apple II, II Plus**, and **IIe**; $125. Dickens Data Systems Inc., Suite A, 3050 Holcomb Bridge Rd., Norcross, GA 30071.



Education

Alligator Mix—A mathematical-learning game for children from kindergarten through 9th grade. Addition and subtraction problems using numbers 0 through 9 are displayed on an alligator's abdomen. The child opens the alligator's mouth to receive an apple with the correct answer written on it. Hits and misses are recorded at the bottom of the screen. For the **TI-99/4A**; $39.95. Texas Instruments Inc., POB 53, Lubbock, TX 79408.

The Author—An authoring system for computer-assisted instruction that helps you create menu and question screens. It provides automatic branching to additional instructions and narrative instructional screens. The program also lets you edit your screens with a built-in word processor. For

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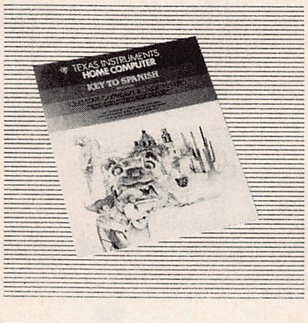
the **Apple II Plus** and the **IBM Personal Computer** with PC-DOS; $195. Phoenix Performance Systems Inc., Suite 1, 324 South Main St., Stillwater, MN 55082.

Career Inventory Assessment—A program designed for school guidance counselors and administrators to help assess students' employment opportunities in the current job market. For the **Apple II Plus**; $79.95. Cust'msoft, Suite E, 485 Broadway, El Centro, CA 92243.

ECS Computerized Gradebook—A filing system that lets teachers store, retrieve, and calculate student grades. This program will store up to 50 names and up to 10 scores per student. For the **Apple II Plus**; $49.95. Electronic Courseware Systems Inc., POB 2374, Station A, Champaign, IL 61820.

Key to Spanish—A program for travelers or business people wishing to learn Central and South American Spanish dialects. The introductory lesson and six subsequent lessons are contained in four software cartridges. Four audio cassettes aid in pronunciation. Requires an audio-cassette player. For the **TI-99/4A**; $149.95. Texas Instruments Inc. (see address above).



The Math Teacher—Addition, subtraction, multiplication, and division drills for students up to grade 8. The level of difficulty can be selected by the student. For the **NEC PC-8001, IBM Personal Computer**, and **Osborne 1**; $39.95. Computech, Department MB-NR, POB 7000-309, Redondo Beach, CA 90277.

Measurement Tables and Formulae—A reference program for students in grades 7 through 12. It contains more than 25 commonly used measurement and formulae tables. This system is menu-driven and features a print option. For the Radio Shack **TRS-80 Models I** and **III**; cassette, $10. DeZoysa Enterprises, POB 170, Keyport, NJ 07735.

Meddle Pruf—A security system for classroom teachers. It lets teachers protect a student's disk with an individualized password. With the master disk, the instructor may copy, write to, or review any student's disk. For the **Apple II** with 48K bytes of memory; $59.95. Microcomputer Workshops Corp., 103 Puritan Dr., Port Chester, NY 10573.

Musical Match-up—An instructional music game in which you try to match the pairs of chords played by the computer. Levels of difficulty range from beginner to advanced. For the **Apple II** and **II Plus**; $25. Notable Software, POB 1556, Philadelphia, PA 19105.

Prof—A package designed to help educators without previous knowledge of programming develop computer-assisted instruction programs. Prof features the ability to keep track of users and their responses, tabulate and record student scores, and control random-access audio tape and slides. For the **Apple II**; $495. Triple i Inc., 4605 North Stiles, Oklahoma City, OK 73105.

Stickybear ABC—An alphabet program for children ages 3 to 6. Colorful animated pictures move across the screen with the name of each object beside it. Also included are Stickybear stickers, an ABC poster, and a 32-page children's book. For the **Apple II**; $39.95. Xerox Education Publications, 245 Long Hill Rd., Middletown, CT 06457.

Languages

C Compiler—An implementation of the C language that allows software authors to write applications that are compatible with **CP/M-86** and **Unix** operating systems. This language features single- and double-precision floating-point arithmetic with 8087 math coprocessor support and enhanced diagnostic and debugging capabilities. For **CP/M-86-based** systems; $600. Digital Research, POB 379, 160 Central Ave., Pacific Grove, CA 93950.

Technical Tools

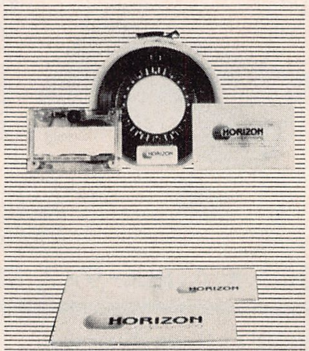
Gale—A programming utility for editing Applesoft programs. Gale lets you execute global search and replacement for specific characters throughout a program and allows line-by-line editing. For the **Apple II Plus**; $39.95. Micro-Sparc Inc., Systems Division, Department P, POB 325, Lincoln, MA 01773.

Libby—A program that catalogs the files and programs on all your disks. Insert your disks one at a time; Libby then reads and saves the information on each disk directory and files it in memory. The file can be reviewed on screen or printed. For the **IBM Personal Computer** with PC-DOS and 48K bytes of memory; $49.95. Advanced PC Systems, 608 Lisa Way, Campbell, CA 95008.

PC-Draw—An interactive tool that gives you the ability to create, store, and print computer drawings. This program will support any type of drawing and combine a light pen with the keyboard to select and manipulate the template symbols. Included are two predefined symbol menus, a flowcharting menu, and an electrical design menu. For the **IBM Personal Computer** with 128K bytes of memory, color graphics adapter, and Epson **MX80/100** printers with **Graftrax**; $250. Micrografx, 8526 Vista View Dr., Dallas, TX 75243.

Word Processing

Horizon Wordprocessing—A full-screen editor that allows easy document creation, complete formatting, and document management. This package includes a reference card, tutorial, experienced users' reference manual, and online help tutorials. For the **Onyx Z-8000, Plexis, Zilog, Motorola, Altos, Computhink Hawk**, and **Corvus Concept**; $750. Horizon Software Systems Inc., 220 Downey St., San Francisco, CA 94117.



Text-formatter—A word-processing program for short letters and memos. Designed for the **Hewlett-Packard 75**, this system includes options for indenting paragraphs and setting margins and lines per page. A letter can be customized by inserting names and addresses anywhere on the page. For the **HP-75**; $95. Contact your local Hewlett-Packard sales office. □

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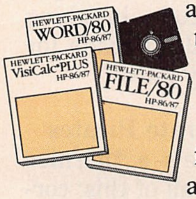

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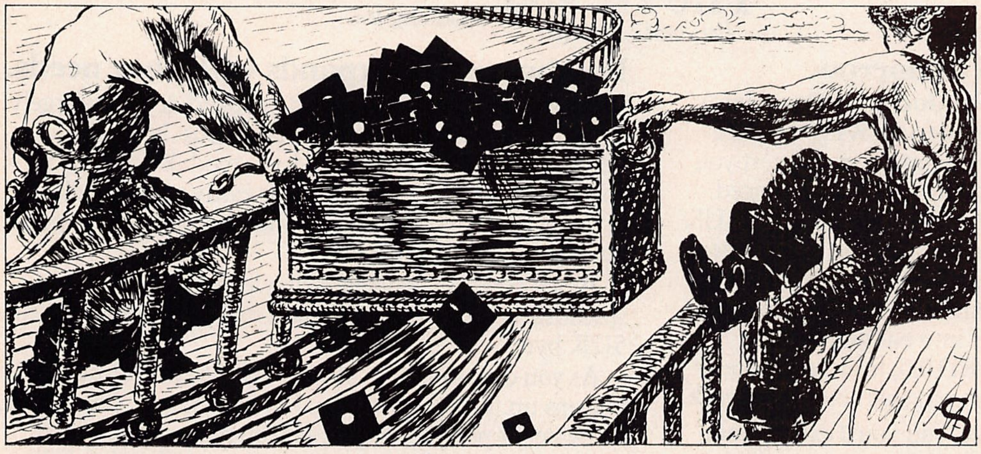
Is Software Piracy Justified?

Yes, say some businessmen, and their reasons sound pretty convincing

by A. Richard Immel



Steve Salerno

Nothing in all computerdom shakes more cages and sets more teeth on edge than the two little words *software piracy*. Mild-mannered software executives have been known to foam at the mouth and become apoplectic at their mere mention, and entire companies have turned paranoid at the thought of someone breaching their elaborate and expensive disk copy-protection schemes. On the other side, subcultures have sprung up whose sole purpose in life is to break those elaborate protection schemes.

Software piracy: it's an ambiguous term that means different things to different people. Depending on your viewpoint, it's either the vilest activity known to humanity or the only way to deal out justice to greedy program peddlers. Somewhere in the middle, software houses and users alike try to puzzle out an answer to a seemingly insoluble dilemma: is piracy justified because software prices are too high, or are software prices too high because of piracy?

The issue is indeed a puzzle. Should piracy be fought, embraced, or ignored? Some companies are splendidly ambivalent—they protect some programs but not others. A few firms rail publicly against the practice while winking privately at it. The hardware pushers are silent—they know software sells iron.

Meanwhile, the pirates persist, and their numbers grow bolder and more colorful: Red Rebel, Captain Crunch and the Buccaneer, Cheshire and The Las Vegas Pimpernel.

Breaking protected software is a big business. I read not long ago that the head of one software company pegged bootlegged software at 40 percent of the entire market. That seems awfully high, but still there's no question that substantial piracy is going on.

Much of this illegal traffic involves games—why pay $29.95 in a computer store for Raster Blaster when you can get it for the price of a blank disk at a local hobby club meeting where coke-guzzling, potato-chip-munching denizens of the twilight world of code breaking ply their filthy trade (or so the story goes)?

The Corporate Pirates

But there's a thornier problem in all of this: corporate piracy. And in this one the lines of moral and legal obligation get fuzzier the harder you squint at them. Unlike their coke-guzzling hacker counterparts, corporate pirates wear dark suits and pale shirts, eat lunch in softly-lit restaurants with linen tablecloths and maitre d's, sip Perrier and charge their meals on American Express Gold cards. Their names are less colorful: they tend to go by titles like chief financial officer, office manager, and senior analyst. But they do have some-

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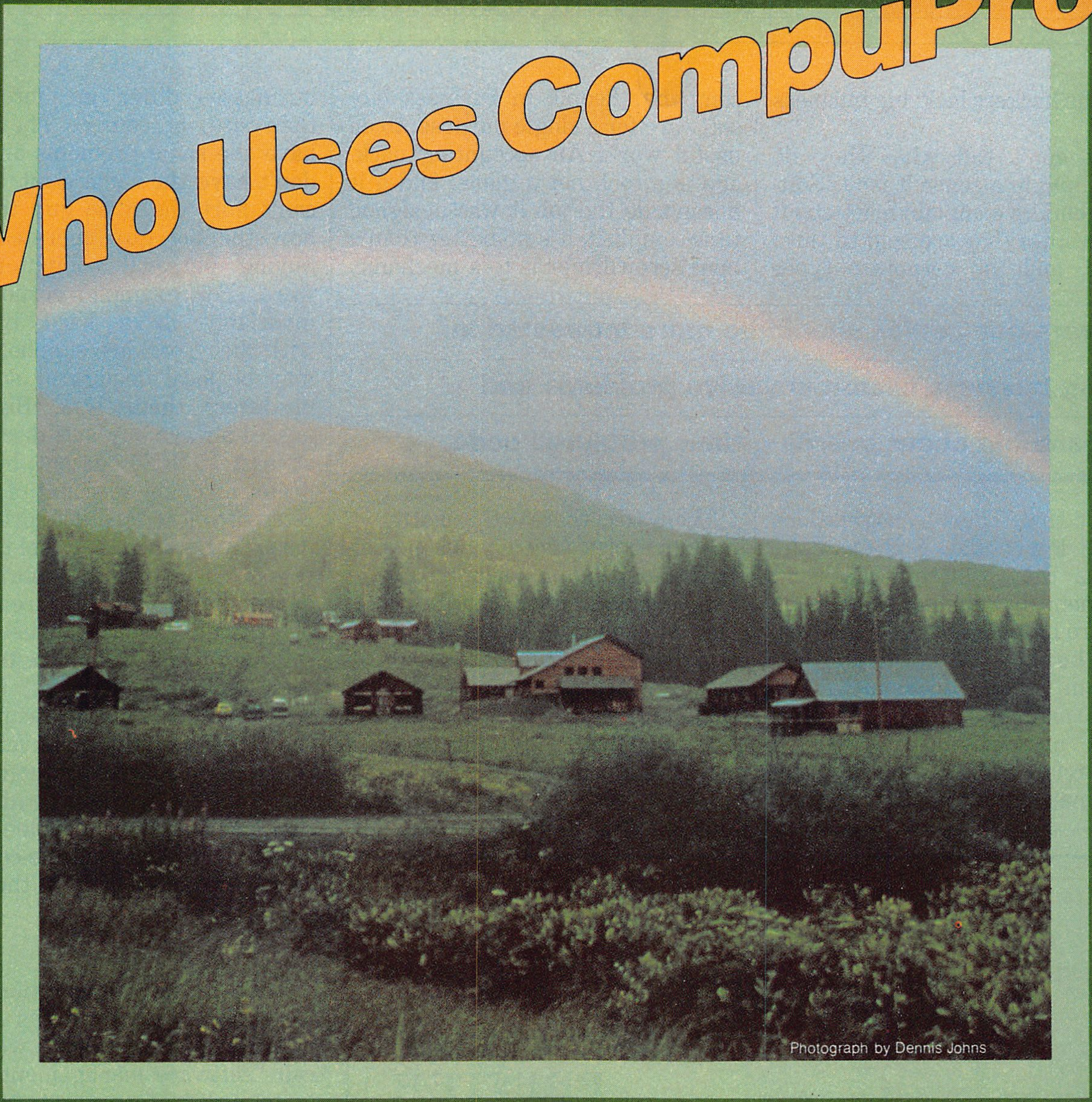
A. Richard Immel is a contributing editor of *Popular Computing.*

Who Uses CompuPro?



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CompuPro, a Godbout company, Oakland Airport, CA 94614 thing the hackers lack: big business savvy.

They don't call what they do piracy, and in a sense it isn't. Software vendors complain most about illegal copies that are sold to third parties, and the corporate types don't do that. Their transgressions are far less venal. For example, perhaps they violate a licensing agreement by running the same software on a number of machines, or maybe they break into a locked program with Locksmith (for Apples) or Copy II PC (for IBM) to remove an annoying bug from a commercial applications program or to make it more useful to the company. People in business buy software for a single purpose: to do useful work. An accounting package is a tool, not a game, and if it doesn't do the job it was designed to accomplish, it's no better than a bent screwdriver is to a mechanic.

Software companies should be more interested in helping business customers solve problems and less paranoid about guarding their protected code.

Then, too, there's the matter of backup copies. Can any business afford to depend on a single backup? (And even a single backup is generous by some software company standards.) The rule of thumb in almost any reliable computer book is that you need a master disk and *two* backups. Anything less is courting a nasty surprise.

Large corporations and small businesses differ in more ways than size, of course. They don't have the same problems and they don't have the same clout. Still, it can't hurt the little guy to know how the big guy operates when buying personal computer software. For example, corporations invariably drive hard bargains with their software suppliers, who may be local dealers or software producers themselves. Big businesses always buy at a discount of at least 15 to 20 percent, but they prefer a "deep" discount of 50 percent or more off list price, apparently because they feel that the product is worth no more. If a dealer balks, they'll threaten to buy from a mail-order house. If the software firms are unable to shape their sales policies to fit the realities of the corporate market, then the corporate buyers will shape those policies for them: "You say you don't want to discount multiple copies? No problem. We'll arrange our own multiple-copy discount—in-house! Fire up the Locksmith, Arnie."

Corporate Realities

Some recent conversations with three corporate executives who are directly involved in what we might call "software management" illustrate just how corporate realities sometimes overrule certain niceties that look good on paper but can't last in the real world. One of these men is an office manager for a Fortune 500 company, another works for a national accounting-consulting firm, and the third is a top financial officer in an industry-leading regional company. These are real companies and real executives, but for reasons that will become apparent, the companies and their representative officers shall remain nameless. In the spirit of the subject let's call them Mr. Finance, the Consultant, and Officeman.

Mr. Finance works for a company that has a predilection for Apples; there are four of them on the premises and another eight

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that company officers use at home. For the twelve machines, Mr. Finance says he bought four master Visicalc disks; he duplicated the rest.

Of course, we could let him off the hook and say that all he and his colleagues elsewhere are doing with their Locksmiths and Copy PCs is making backup copies, something to which they're legally entitled and which the sellers of Locksmith, for one, feature in advertisements as the "sole purpose" of the disk-cracking program.

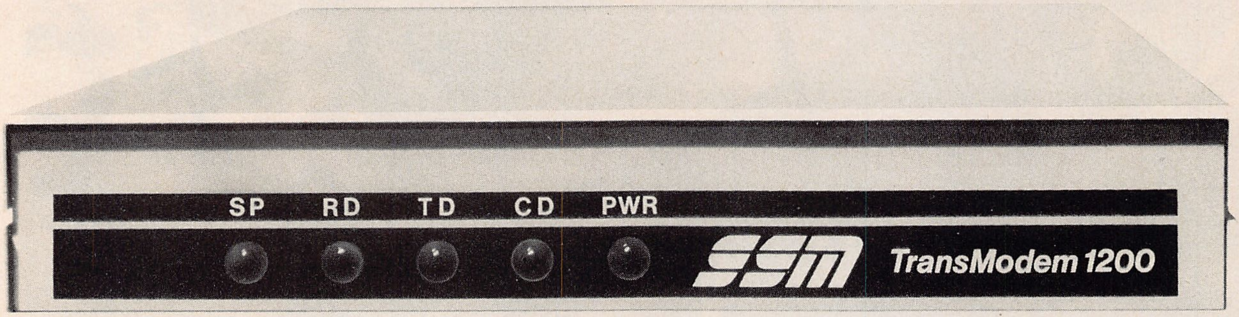
Nice try, but no cigar. "We're not using the duplicates for backup," reveals Mr. Finance frankly. "We've never had a Visicalc disk crash, so we don't need them for that. They're for convenience. Why should someone have to walk the length of the hall to get a Visicalc disk from another guy's desk?"

But there's more to it than that. Mr. Finance continues, "We've got $1500 invested in that company (Visicorp) for its software. It's a question of where you draw the line. I think with $1500 in any one program we ought to be able to use it throughout the company. It's not like we bought one and duped the other 12. Besides, we never have more than one running at a time anyway."

The Consultant represents another point of view. He doesn't believe in duplicating copy-protected software, although it's not beyond his power to do so. His company is a heavy user of IBM Personal Computers, but the temptation to duplicate spreadsheet programs such as Visicalc has been eliminated by bundling that software into the purchase price of each machine. For some of its other applications packages, the Consultant's company uses the library concept. Word-processing programs, for example, are kept in a central location and checked out like library books.

There's nothing wrong with this, right? Wrong. If you read the fine print that accompanies most software, you'll see that what you've bought is a "licensing" agreement that limits use of the software to a single machine: one copy, one machine. So isn't the Consultant technically breaking the law? "Well, yes, technically it's illegal," he concedes. "But I don't have any problem with that because right now we've got more copies of the program than we have machines."

Officeman, our third buccaneer, also prefers IBM PCs, but like Mr. Finance, he's not in any mood to help Visicorp or Micropro or any other software company get rich on his company's software needs. As for the problem of riding herd on the one-copy-one-machine requirement, Officeman claims that it's not a concern for most companies.



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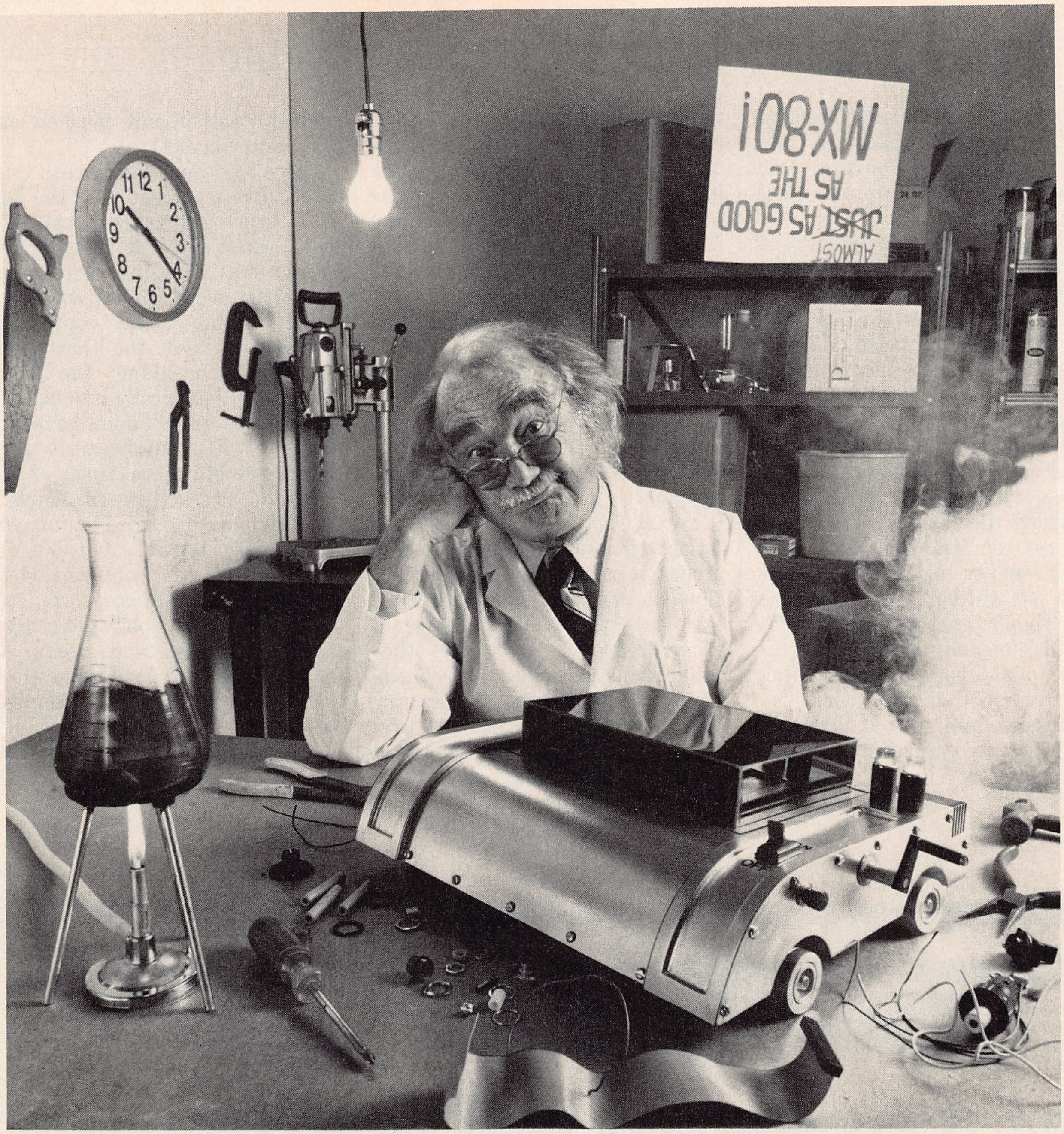
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Create your own alphabet.

With the new FX-80, you aren't limited to ASCII characters. You can create your own. Any character or symbol that can be defined in a 9x11 matrix can be added to the FX-80's already impressive library of type styles and stored in its integral 2K RAM.

So you can create "Sally's Gothic" or "Tom's Roman" just by downloading and modifying standard characters. Or you can create a custom set from scratch. Either way, you can store up to 256 new characters. And if you don't need a new alphabet, the RAM functions as a 2K data input buffer.

Who knows graphics better than Epson?

Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

And *that* is in addition to an astonishing array of 136 different user-selectable type styles including Proportional, Elite and Italic as well as the more conventional faces you get on other printers.

Hard-to-beat hardware.

The FX-80 has all the hardware features you've come to know and love on the MX Series: logic seeking, bidirectional printing, the by-now-famous disposable printhead, and more.

The FX-80 features an adjustable pin platen or optional friction/tractor feed, so you can use fanfold, roll or sheet paper . . . backwards or forwards. The FX-80 even gives you reverse paper feed.

And if you're printing forms, the FX-80 has a feature you're gonna love: a function that allows you to tear off the paper within one inch of the last print position.

Be the first on your block.

We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

And while you're there . . . ask them to show you how it works with our computers.

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As he reports, "The rule of thumb in the business is 20 copies for every 100 users. No software companies are going to challenge that." If they do, it's tough toenails: "The corporation will stop doing business with them," he says, which is a threat with real teeth in it when you think about the number of personal computers that big companies like Officeman's are going to be buying in the next couple of years.

Officeman's assistants use Copy II PC to break copy-protected software so that they can put it on hard disks for their IBM PCs. (Most copy-protected software can't be loaded onto a hard disk without first breaking the copy protection.) However, true to his corporate breeding, Officeman leaves the details of such things, including possession of the copy breaker itself, to his subordinates. "I don't want to know about it," he says.

The fine print says you've bought a "licensing" agreement that limits you to using one copy of the software on one machine.

Super Pirates

Let me backtrack a minute to the Consultant. As I alluded to earlier, the Consultant is something of a Superman when it comes to breaking and entering, although it is something he is loath to do without intense provocation. "I can break any software protection scheme in the industry," he says flatly. "Visicalc, Easy Writer, you name it." As he says this, a pride bordering on gusto creeps into his voice, but he catches himself and quickly adds that because of his firm's high visibility, disk cracking is strictly against company policy and simply is not done. "We can't afford to have Visicorp coming after us," he explains. Besides, as with the real Superman, his is a power to be used only for good, never for evil. The chance to use his power for the good comes when he's in a desperate consulting situation with a client who's been ripped off by an unscrupulous software company.

The Consultant tells a story about such a case: a client firm purchased an expensive accounting package only to discover that, after spending two years of effort and four times the program's cost, it still wouldn't run a payroll. As a last resort, the Consultant got a copy of the offending software and proceeded to perform his magic on it. "First I broke all the access and source codes—that took 3½ hours. Then I modified it—that took 8 hours—and sent a copy back to my client. He had his system up and running in two weeks." Remember, this was after two years of frustration with the program.

But that was just the beginning. When officials of the software company learned of the unauthorized modification, they went through the ceiling screaming about ethics, honesty, and theft. "They said they were going to sue," he says. Now, the Consultant knows his stuff, and nothing riles him more than someone questioning his integrity. "I'll talk about ethics, honesty, and theft," he shot back darkly. Then he made sure word got around about the accounting package's problems. Within days every hardware manufacturer who had signed up to sell the software package with its equipment had dropped it. There was no suit.

The problem of bug-ridden commercial software is not isolated; it's one of the biggest gripes businessmen have about locked software. I know of another company that was having trouble a couple of years ago trying to get its Visicalc program to do a special kind of printout needed for a certain routine report. This firm had hired a young computer science student from a local university to help smooth out the bumps on what was then the company's rocky new road to microcomputers.

Like any computer science student worth his salt, this one was perfectly capable of cracking Visicalc and making the necessary changes, but to save himself two days of extra work he called Personal Software (which is what Visicorp was called before it changed its name) and asked if someone would tell him where to find the printer routine in the program. It was a short conversation; the software guy at the other end hung up.

I have no personal experience with the company, but presumably now that it has established its identity Visicorp/Personal Software is more interested in helping business customers solve problems and less paranoid about guarding its protected code. Unfortunately, plenty of other software houses out there exhibit what businessmen consider strange and unfriendly behavior, and as long as that condition exists, business computer users will find justifications for rummaging around inside protected software.

Justifying Piracy

And so we get to the bottom line: is the point of all this to justify software piracy in corporate America? Not really. The justifications that may exist are self-evident. The point is simply that those involved in small businesses shouldn't allow themselves to be bullied by software companies that think they still own the programs they've sold—especially not by the ones that want to make a lot of money but seem to have a hard time putting out sound software products.

There are many reasons for copying and breaking software, and some of them are even pretty good ones. What should you do about it? Maybe you ought to do what the big boys do: let your conscience be your guide. ☐

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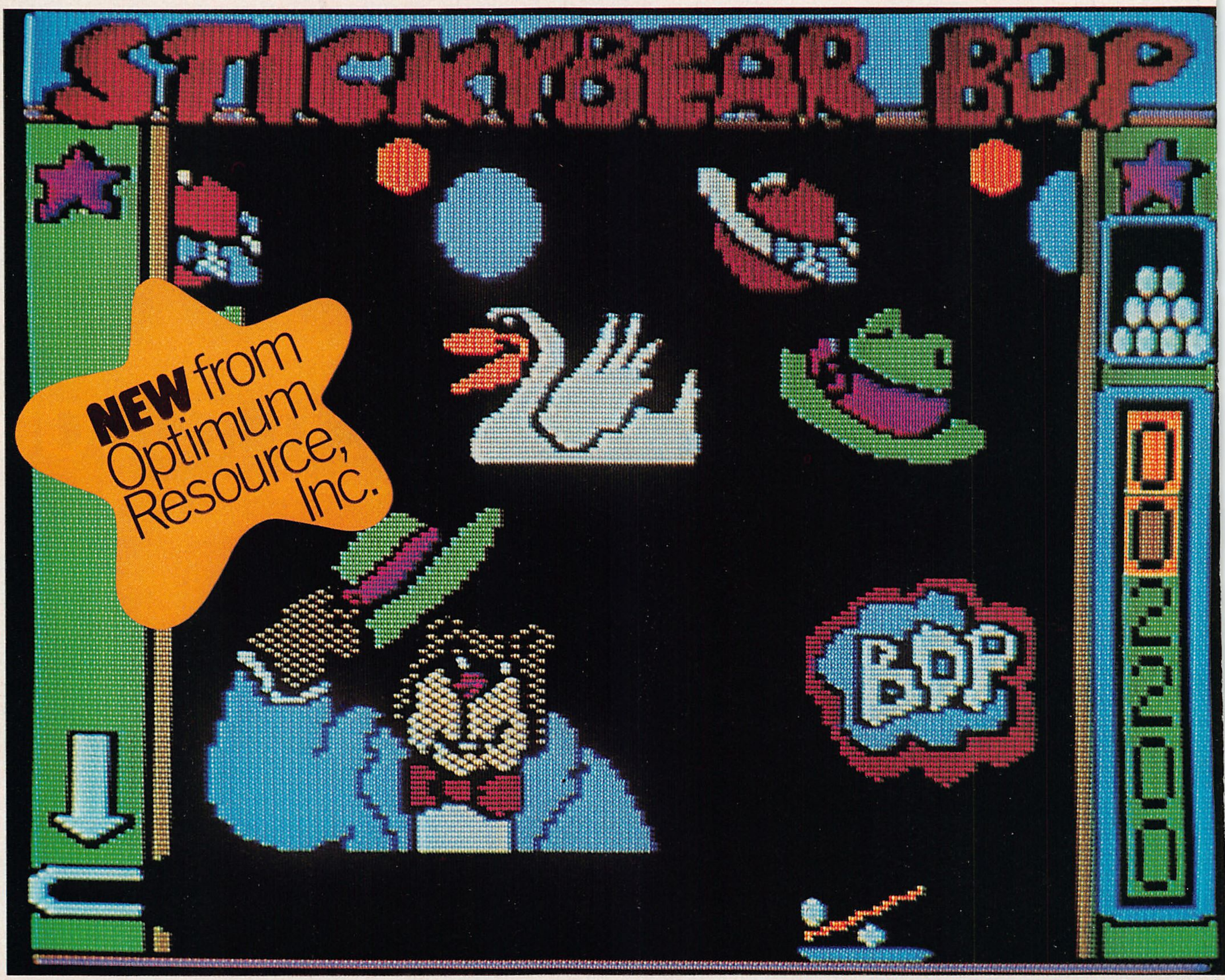
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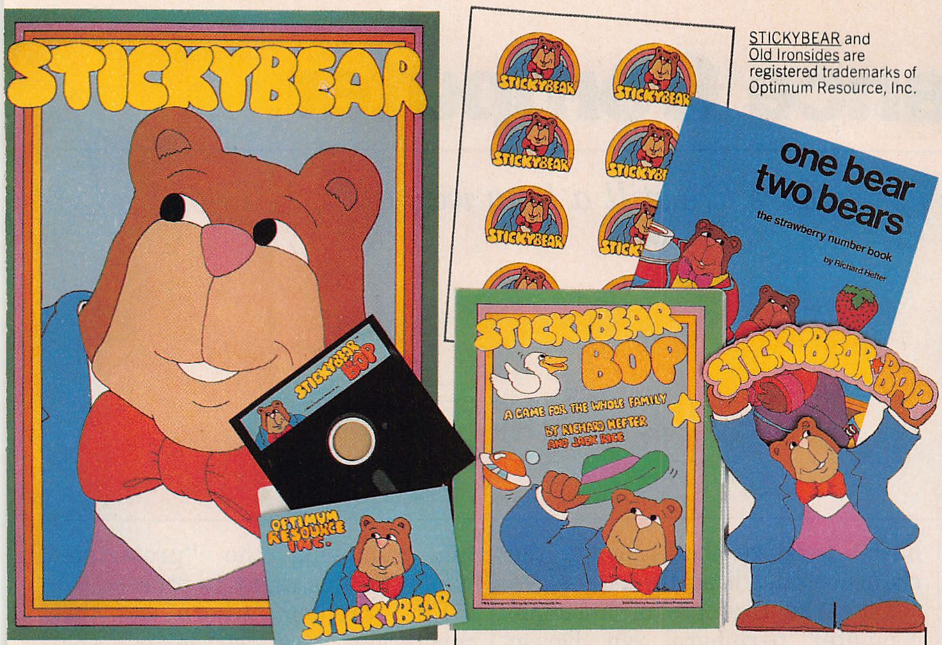
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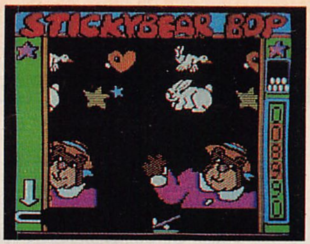

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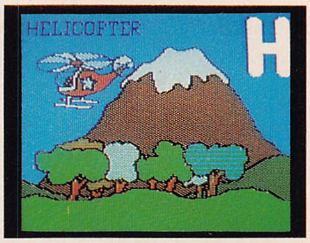

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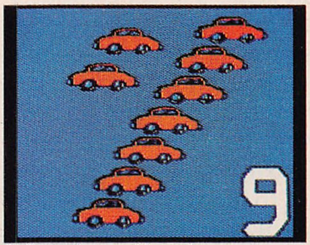

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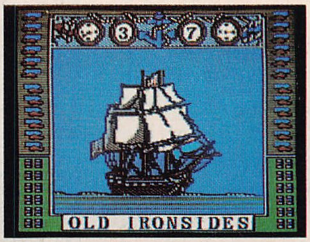

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WHAT DO YOU DO AFTER YOU PLUG IT IN?

The Appliance Computer

Computers as easy to use as toasters are still a long way off

by William Barden Jr.

When this column first appeared back in December of 1981, I suggested that buying and using a small computer was not all the advertising brochures or computer salespeople would have you believe: getting a computer system to work for you was far from easy. It took dozens of hours to learn how to operate the system, not to mention hundreds of hours to learn how to program, and many pitfalls trapped all but the wariest and wisest of users.

I'd be happy to report that that deplorable situation has completely changed, but such is not the case. Most of the problems discussed then still plague us, and they show no signs of letting up for at least the next few years. Let's examine some of these problems far away from the capped teeth of that smiling computer salesman.

Learning the System

The ideal computer system is often referred to as the "appliance" computer—you unpack the system, plug it in like a toaster, and *voilà!* Buttered scones with tea. This ideal still hasn't been reached, despite the claims of sales literature.

Take the example of a simple computer peripheral, an Epson FX-80 printer that I bought recently. (This is not even a system, mind you, but just one element of a computer system.) I opened the box and looked for the printer manual. Sure enough, it was in plain sight and did include instructions for unpacking and installing the printer. After duly "counting the parts" and removing the "protective paper," I was ready to proceed.

First problem: where was the mysterious "release lever" the manual referred to? Second problem: where does the paper feed through? Third problem: why did the paper keep jamming when I tried to eject it by using the manual controls? Fourth problem: how do you turn on the local self-test? After about two hours, I finally had the printer set up and plugged in, had run the self-test, and had connected the cable to one of my computer systems.

Next set of problems: how should the tiny control switches on the side panel be set? Should I select the input buffer? Should I activate the "skip over the paper perforation" option? Should I use the automatic linefeed? It took another hour to sort out all of this. It happens that I knew the answers to most of these questions, but I can guarantee you that the beginning user would not.

At this point I hadn't even gotten to the actual operation of the Epson under computer control. In fact, I'm still working on the 70 or 80 separate commands that are available on the FX-80.

Illustration by James Grashow

My point is obvious—when a printer can literally take hours to unpack and set up and dozens of hours to learn how to use, we're a long way from the appliance computer. Common sense tells you that the entire computer system—the computer itself, disk drives, printer, modem, serial interface, and other options—is going to take you at least dozens of hours to set up and begin to operate. A computer system is not like a toaster. It is an elaborate, complicated piece of machinery that can perform an infinite number of tasks, and as such it does require time before you can begin to use it effectively.

There are a few shining exceptions to this generally discouraging report. Recently announced computers like Apple's Lisa, Radio Shack's Model 100 portable computer, and Epson's QX-10 Valdocs system all make computer operation easier for the total novice than ever before. We can hope that these isolated systems will be imitated and even improved on.

The Software Problem

Almost two years ago when I wrote that first column, applications programs for small computers were few and far between. Visicalc was available, but many other key applications programs simply did not exist. Today the situation is different, at least for the popular machines. A huge base of varied applications is now available for machines such as the Apple II, the TRS-80 Models I and III, and the Atari 400 and 800. The introduction of IBM's Personal Computer has brought hordes of minicomputer and mainframe software houses into the microcomputer world.

In addition, software developed privately for small computers has made the big leagues. Although one- and two-person software companies still proliferate, more and more large operations with good financial backing are offering powerful software packages produced after extensive testing and modification.

Now for the bad news. Suppose you want a specialized program that doesn't exist, or say you want to customize an existing program to meet your own specifications. (Despite the number of applications programs available, this need frequently arises.) Or suppose that you've gotten a newly introduced system that hasn't been around long enough to have that large base of programs available for it. What do you do in these cases? Your options are the same as they were two years ago: hire a programmer or do it yourself.

Hiring a Programmer

Professional programmers in industry make anywhere from $5 to $30 per hour, with the average probably somewhere around $15. Add overhead for equipment, facilities, and expenses, and you're probably looking at a minimum of $30 per hour for custom programming. The more complex the system, the higher the hourly rate, of course, but let's use $30 as an hourly programming rate for such systems as the Apple II and III, TRS-80 Models I and III, and the IBM Personal Computer.

How many hours will it take a programmer to write a given program? Believe it or not, when such estimates are made in industry, they are based on about 20 instructions per day for average programs. This 20-instructions-per-day figure includes the program design specifications (which detail what is to be in the program in the way of screen displays, report formats, and the like), program coding (instruction sequences), program debugging, and final documentation. Also, longer and more complicated programs mean fewer instructions per day because such programs have more interwoven paths to design and debug. We'll use 20 instructions per day as a good estimate, though.

The next question, of course, is how long is a typical program. Depending upon the application, programs may be anywhere from several hundred to thousands of instructions. Let's say that a typical BASIC program for a not-too-complicated special application might be 600 instructions.

Now let's see—600 instructions divided by 20 instructions per day multiplied by 8 hours per day times $30 per hour gives us . . . omigosh! $7200! Can that be right? Yes, I'm afraid that exorbitant figure is correct. Unfortunately, there's no question that it does take a great deal of time to develop programs. Frederick P. Brooks Jr. says in *The Mythical Man-Month* (Addison-Wesley, 1974) that probably 5000 man-years went into developing the operating system for IBM's large-scale 360 computer. Think of it—that's the equivalent of 1000 programmers working for five years!

Doing It Yourself

In case spending thousands of dollars for custom programming is more than you're prepared for, why not do it yourself? It's "simply" a matter of learning a microcomputer language such as BASIC or Pascal.

Even with those hundreds of computer books that promise to teach you BASIC in several days, you've probably found out by now that it's not quite that easy. It's one thing to throw together some simple code that will make a great demonstration for the relatives, but it's quite another to design and implement a fast, efficient accounts-receivable system.

How long does it take to become a competent BASIC programmer? Probably 300 hours at the very least, and that's if you have the aptitude. The average case might be closer to 500 hours. I'm certainly not suggesting that it can't be done, only that it is more difficult

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Columnist William Barden Jr. lives in Mission Viejo, California, and writes about small computers. *What Do You Do After You Plug It In?*, a collection of the author's *Popular Computing* columns, is scheduled for publication this summer by Howard W. Sams and Company Inc.

than you've been led to believe and that it does take some time to get to the point where you can efficiently design and implement a typical applications program.

Unless you're prepared to spend thousands of dollars to have it done or to invest hundreds of hours of your own time in learning how to program, there seems to be no clear-cut solution when you can't find an existing program that meets your needs. Will this situation improve? Given enough time and enough programmers at keyboards, probably every program will be written—unless, of course, newer and slightly different machines keep appearing and wooing computer users from their old equipment.

In addition to the problems of learning to use your system and learning to program, some other difficulties that made computing less than a joy several years ago still exist today. Here's an update on what they are and how to solve them.

How to Test New Equipment

One of the old problems that's still with us is the difficulty of testing new equipment (especially for the new user). The 90-day warranty on new equipment is in some cases simply not enough time to put the system through its paces.

Suppose, for example, that you've just purchased the FX-80 printer I mentioned previously. This is an intelligent printer, with a microprocessor that offers a great deal of built-in logic and an integral program that features proportional spacing, programmable character sets, plotting, and more. Just for the sake of argument, suppose that in one of the thousands of instructions in the printer program one flaw affects one of the printer's 70 or 80 functions. It's likely that you'll never discover that flawed function during the 90-day warranty period; there are just too many functions and combinations to test in the printer.

The same situation holds true for a new user with a new computer system. This beginner will have his hands full just trying to become familiar with the system, much less trying to test all its capabilities. By the time he's learned how to do simple BASIC programming and is able to run applications programs, the warranty period will have long expired.

One solution to this is to run diagnostic programs that will exercise all of the system's components. These programs will exhaustively test the equipment's functions and report any malfunctions. Unfortunately, diagnostics are not readily available. Although some manufacturers furnish built-in diagnostics that work as soon as you turn the computer on, most manufacturers do little in the way of providing a comprehensive checklist so that you can ascertain that everything in the system is working. This area is neglected not so much because the manufacturer is trying to conceal malfunctions, but primarily because diagnostic software is very complicated and ranks far down on the list of priorities for software development.

Computer equipment has become more and more reliable over the past several years. Better quality control in manufacturing, fewer and more reliable electronic parts to perform the same functions, and better design are a few of the primary reasons for increased reliability. However, small computer equipment still fails. You can expect problems with your main computer unit about once a year, and electromechanical peripheral devices such as printers are likely to malfunction more often than that. When equipment *does* fail, follow these tips:

- Try to isolate the failure to a single component of the system (this gets harder and harder to do as systems become more integrated).
- Is the failure always there or is it heat-related? Some failures may occur only after the equipment heats up or, in rare cases, cools down.
- Is the failure in the hardware or the software? Does the failure occur during only one program or during many programs? Obviously, if smoke is pouring out of your computer case, then it's a clear-cut hardware failure, but other cases are not so straightforward.
- When a failure has occurred, try to isolate it to the simplest possible case. If the failure happens in a large BASIC program when using arrays, for example, see if you can reduce the failure to one or two BASIC statements. In this way you'll be better able to define the problem to the person who will be doing the repairs.

Dealing with Software Problems

Several years ago, much independently produced software was, pardon the expression, garbage. Even software packages from large manufacturers had unacceptable numbers of bugs. What's the situation today?

Software comes in several forms in today's equipment. Many times, as in the case of the FX-80, it's buried inside the computer equipment, where it replaces hundreds of equivalent electronic components. In some instances, it's programmed into the computer's ROM (read-only memory), as is the case with the BASIC interpreters in many systems. Other software is on disk or cassette as applications or utility programs.

Does most software have bugs? Yes, almost all software from Apple, Radio Shack, Texas Instruments, IBM, and every other computer manufacturer has bugs. Recently, however, manufacturers have put a great deal more effort into quality control. (A program I just finished for Radio Shack went through four months of preliminary testing!) As a result, the bugs that do survive tend to be few and relatively obscure, which is not to say that they can't be catastrophic in some instances.

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than the computer manufacturers still ranges from abysmal to excellent. Knowing the reputations of the various vendors is the key. Word of mouth helps here.

Comprehensive testing of software is not worth your time—there are just too many combinations to test them all efficiently or effectively. Go ahead and use the software, but don't be surprised if glitches appear. Try to note the conditions under which you have problems, and then contact the manufacturer to see if a software fix or patch is available.

Will the problem of bug-ridden software diminish? Probably not—it may even get worse as larger packages are developed in the heat of competition.

Service Is Still a Hassle

Servicing a failing computer system is still a problem. If your system is from a major manufacturer, you won't face problems finding service facilities (unless you are "unlucky" enough to live far from urban smog and traffic congestion). However, you may have to wait weeks to get your equipment back.

If you don't have equipment from a major manufacturer, or if you have peripheral equipment that does not carry the computer manufacturer's label, you may have more severe problems. Case in point: when I received my FX-80, I noticed the feed mechanism squeaked as it ejected paper. The paper also tended to jam on one side. I had purchased the printer from a local dealer offering cut-rate prices, and I took it back thinking that I could simply switch for another unit. This was not to be. The dealer's position was that the printer, even though it was brand-new, must be sent to the factory for service that could take as long as two weeks. Switching units was out of the question. After several minutes of nose-to-nose discussion, he promised to expedite the service. I don't expect to see the FX-80 for several weeks.

Will service conditions improve? Probably not. About all you can do to protect yourself is to have some redundancy in equipment (spare peripherals) if you can afford it. If you need the equipment in day-to-day operations, you might consider buying your entire system from the computer manufacturer, who will probably give you faster repair service on peripheral equipment than would the original equipment manufacturer.

One Major Improvement

To end this update on a positive note, I sincerely believe that documentation for computer hardware and software has improved significantly. One of the reasons for this is that computers are now bigger business than they used to be. Also, the large number of beginning users means that manuals must be clear and understandable.

Another bright light on the documentation scene is the fact that the amount of information about computers has increased four-fold in a year and a half. Computer books, once relegated to an obscure spot near the rest room in bookstores, now occupy four racks near the center of the store. While it's true that many of these books are geared to the basics of hardware and software, at least there's a great deal of information to supplement the manufacturers' manuals.

To sum it all up, then, we find that many of yesterday's problems still exist and show few signs of abating. At least for the next couple of years, it looks like we'll have to keep plugging away and putting up with the difficulty of learning system operation and programming, the expense of customized software, the mysterious hardware failures, the software bugs, and the service problems. But we're a hardy and resourceful bunch, right? ☐

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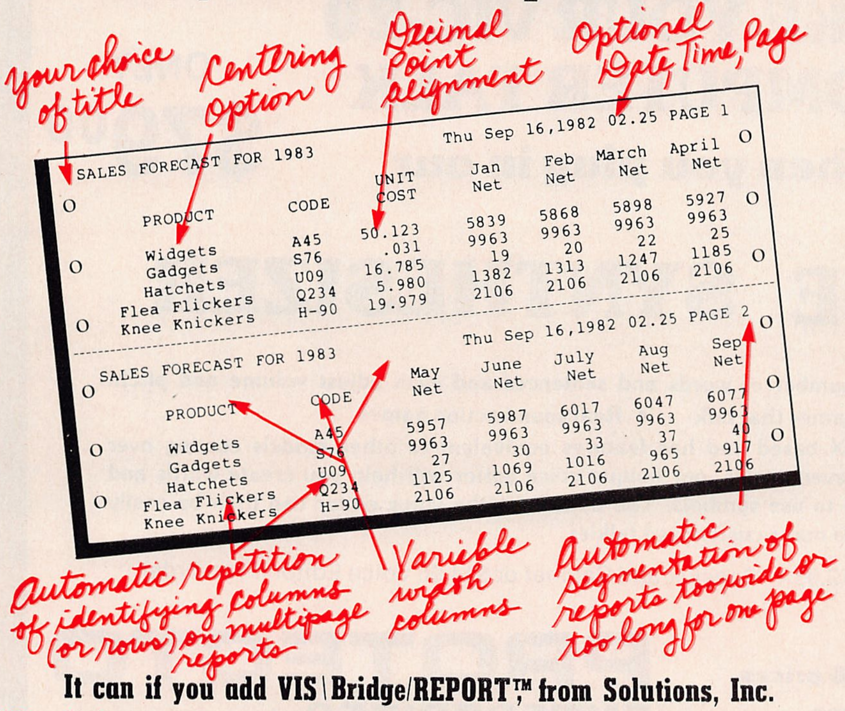
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                                      Thu Sep 16,1982 02.25 PAGE 1
SALES FORECAST FOR 1983
                              UNIT       Jan     Feb   March   April
                                         Net     Net     Net     Net
    PRODUCT          CODE     COST
                                        5839    5868    5898    5927
    Widgets          A45    50.123      9963    9963    9963    9963
    Gadgets          S76      .031        19      20      22      25
    Hatchets         U09    16.785      1382    1313    1247    1185
  Flea Flickers      Q234    5.980      2106    2106    2106    2106
  Knee Knickers      H-90   19.979
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                                      Thu Sep 16,1982 02.25 PAGE 2
SALES FORECAST FOR 1983
                              May       June    July     Aug     Sep
                              Net        Net     Net     Net     Net
    PRODUCT          CODE
                                        5987    6017    6047    6077
    Widgets          A45      5957      9963    9963    9963    9963
    Gadgets          S76      9963        30      33      37      40
    Hatchets         U09        27      1069    1016     965     917
  Flea Flickers      Q234     1125      2106    2106    2106    2106
  Knee Knickers      H-90     2106
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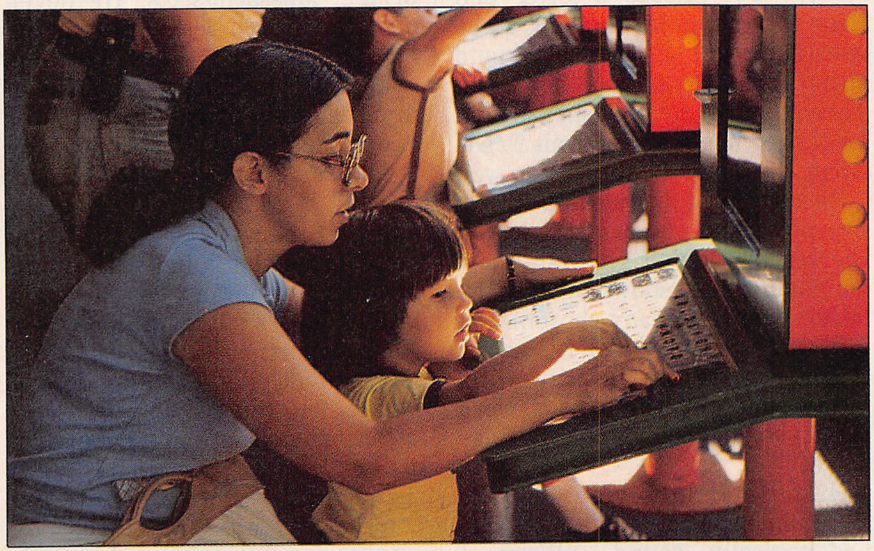
Games Designed for Learning

Finding the right software for your children can be a real challenge

by Dan Watt

If you follow trends, you may have picked up on an interesting one lately in educational computer programs for kids. During the past six months, a flurry of ads in computer magazines of every sort has been promoting a new breed of educational software. Rather than focus on the mundane practice of basic skills or on the rigors of learning to program a computer, this software promises "fun with learning at home."

Indeed, this game-oriented approach to learning, which stresses the enjoyment of learning instead of the drudgery, is capturing the imagination of software companies in a big way. Established educational publishers such as Reader's Digest, Xerox (which publishes *My Weekly Reader*), and Scholastic have entered the home software market in full force. Specialized publishers such as Spinnaker Software and software developers such as The Learning Company and Control Data are making a strong pitch for your home education dollars as well. (See "Informal Learning," March 1983, page 60.)



Mother and daughter learning together at the Sesame Place theme park in Pennsylvania.

A proliferation of innovative software from these companies over the next few years spells great news for parents. But along with it goes the increasingly tricky task of finding the right software for your children. How should a parent think about choosing software for learning? What sorts of questions should you as a parent be asking? What kinds of models should you have in mind when you look at this new software?

To help develop a framework for answering these questions, I spoke with two leading software developers, Joyce Hakansson and Tom Snyder. Both Hakansson and Snyder develop games that are designed to support informal learning. Both produce software intended for the home market and are sensitive to the needs of the marketplace. In addition, they are devoted to designing pedagogically sound software. By creating new products that fire the imagination and expand the capabilities of today's computers, they are helping to set standards that will shape the future of the industry.

Learning through Play

Joyce Hakansson, who heads her own software-development company in Berkeley, California, believes that a playful approach to learning is critical in designing and evaluating educational software. Through her work as director of software development for Sesame Place, a theme park for children in which computers play a major role (see "Hands On," June 1982, page 110), she has been at the forefront

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Dan Watt is a contributing editor of *Popular Computing* and author of *Learning with Logo* (BYTE Books/McGraw-Hill, 1983).

Photograph by Alan Orling/Black Star

of creating computer-based learning environments.

"The personal computer is the play tool that's going to open up the information age, just as the car opened up the mechanical-industrial age," says Hakansson. "As children we learn about our culture and become socialized through play. As parents we play peekaboo with our children and teach them language. As we grow older we test our roles in life by playing house, playing policeman, or whatever."

Although most of today's adults have grown up without having had a chance to play with computers, Hakansson believes that children's computer play can benefit adults as well. "As adults, we're supposed to be serious, and we get guilt feelings when we play too much. But we do encourage our children to play. We recognize that it's beneficial to them. Look at the multimillion-dollar toy industry."

It follows, she says, that "If we can construct a child's play environment, parents may enter it with their children. That's what has happened at Sesame Place and at the Lawrence Hall of Science in Berkeley. When the family enters, Mom and Dad follow Johnny and Susie over to the terminal and help them read the instructions. Pretty soon they're saying, 'Oh, no, don't press that key; press this one' and pressing the keys themselves. And Johnny and Susie have served their purpose. They go over to the next machine and have a ball because now they're free to explore. Mom and Dad have gotten over their inhibitions, and they're free to play, too."

Creating a Learning Game

Although play is a critical element in Hakansson's approach to learning, software development involves a lot more than that. Here's how she describes the evolution of a game called Raise the Flags, which was originally developed for Sesame Place and is now available as part of a set of Discovery Games from Apple Computer Inc.:

"I've always loved the word game Hangman. But I have some problems with it. It's violent in nature, and I don't want to give children images that are inherently violent. And the usual computerized version of Hangman features negative reinforcement; that is, when you get the word *wrong* you see these really gaudy graphics. You never even see the word you're building. That becomes secondary.

"What we wanted to do was build a nonviolent game that featured positive reinforcement when you did something *right.* We wanted it to draw attention to the word you were building—that's the reason we were making the program. The whole process took almost a year to complete. Our question was, how do we get people to look at the word, visualize it, see it being built, and want it to be built? Eventually we came up with the idea for Raise the Flags.

"Here's how it works. All the letters of the alphabet are on the screen. You choose a letter and then watch this little fellow as he goes and looks at your letter and either nods or shakes his head. There's a moment of suspense—did I get it or not?—as you wait to see what he does. If the letter you guessed is right, he raises it up on a flag pole. And you can still see all the letters you've got left (most hangman games show you only the letters you've already chosen). It's fast, it's amusing, and it's got a character you can identify with. When you get the whole word right, the bugle blows and the flags wave."

Hakansson has very definite ideas about what makes a game pedagogically sound. "When I build a program," she says, "I want to make sure that every aspect of it—even the most subtle—serves an educational purpose. If I want a child to build words, then building words should be a powerful tool to make something happen so that the reward is inherent in the activity. I don't like a smiling face or a frowning face on the screen; that implies that the machine knows whether a response is right or wrong and that it can approve or disapprove of what a child has done.

"When a child uses one of my programs she is entering my world, and I want that world to reflect my values. I like a world that's pretty. I like a world that's humorous. I like a world that's racially integrated and nonviolent. I don't want violence on the screen, and I don't want children to feel that it's okay to launch a missile against a city somewhere. And I don't want anything that's racist or sexist in a world that I build for children."

Learning through Collaboration

Like Hakansson, software developer Tom Snyder believes that playfulness is the essential ingredient in a computer learning activity. A part-time schoolteacher, Snyder heads his own company, Tom Snyder Productions, in Cambridge, Massachusetts. He developed the Search Series, distributed by McGraw-Hill's School Division, and Snooper Troops, a series of mystery-adventure games for young detectives, distributed by Spinnaker Software, also of Cambridge.

Snyder believes that any computer game that's fun to play can provide a framework for learning if it lets players stop and think, provides opportunities for collaboration, and includes a healthy dose of fantasy and role playing.

"Even Pac-Man could be an educational game if you could freeze the action," says Snyder. "You could get higher scores by estimating distances and speeds and analyzing possible routes, as opposed to acting totally instinctively.

"The second thing is to put in as many opportunities for collaboration as possible," Snyder advises. If you do that, he says, "You'll get kids saying, 'C'mere a second, and bring a pencil' or, 'C'mere a second and operate that while I operate this.'" If you combine collaboration with a break in the action, Snyder says, "Kids start theorizing—talking out loud and making their thinking explicit. And once a kid suggests a theory to someone else, it circulates and is proved or disproved."

The third element of a successful learning game, according to Snyder, is some kind of role playing or fictional aspect. "You could have a book with the game that tells a story or provides maps or notebooks to get the kids more involved. Or include characters and roles that kids can fantasize about and identify with."

Spying on the Computer

"The next game that we're coming out with," says Snyder, "can't be played by one person. It's called Capture the Flag, and it pits two kids against four little machines. Each kid is responsible for one side of a split screen, but they play together against the computer instead of against each other. The kids have to defend their flag and go down and get the machine's flag. Meanwhile, the machine is trying to do the same thing, and the machine plays a smart game. By pressing a certain key, the kids can freeze the action and begin to figure out strategies.

"We've added one more thing to make the game more educational and more interesting," Snyder continues. "If you press a certain key, you can hear the computer 'talking' in binary code to its little machines, telling them what to do. When you press this key, you can hear and see one of the enemy robots send a binary question to Max, which is the name of the computer. They go 'beep-beep-beep,' and Max beeps back with an answer in binary.

"Kids have to translate from binary to decimal to find out what Max is telling its little guys to do. The answer is in the form of a number. The robot might call and say, 'Where am I?' and Max might say, 'You're in sector 100001 (33).' And the robot might say, 'Yes, but where should I be headed?' And Max might respond, '37.' And the robot could ask, 'Where's the flag?' and Max would say, '32.' The whole game is based on a big, colorful, simple numbered grid instead of a map. All the questions refer to that grid. One of the mysterious things you can do is pretend you're a robot and ask Max your own question, and he will answer you. That way you can learn his strategy.

"Although we're still testing the game, we've already found that both boys and girls like to play it, and it has a lot of valuable educational content. Kids learn about strategic thinking and how to plan ahead. They learn to cooperate with someone else. And if they want to make the effort, they can learn something about binary numbers, even though that's not the main purpose of the game."

Choosing Educational Software

Tom Snyder thinks the most important thing parents should do before choosing educational software is to see their children use it. "It's almost impossible to understand how an activity like this works without seeing it in action," he says. "Parents should find someone who has the program or go to a computer store and try it out with their own children before taking a chance on software they know nothing about. If they can't try it out, they should rely on word of mouth from other parents."

Joyce Hakansson also thinks that parents should have a chance to try software before they buy it. Furthermore, she says that parents should apply the same kind of reasoning in making software choices that they use for other parental decisions. "A parent shouldn't be snowed by the technology," she says. "Parents are always making choices for their children. They choose toys, clothes, activities, all kinds of things. They should use all their understanding of their own children when they make choices about software."

Hakansson is concerned about the effects of some video games and the consequences of using arcade-style violence—a current trend—to motivate a child to practice arithmetic or spelling. "Parents should make sure that what they bring into their own homes reflects their own values. If they don't want violence, they shouldn't bring it into their homes through this kind of activity."

When pressed for what to look for in a game, Hakansson offers her own criteria for deciding about new projects. "Before we build a program, we ask ourselves a series of questions. Why do we want to do this activity? Is it better done with a computer than with other media? How will a computer enhance it? Is it something that children will enjoy? Is there a real learning purpose to it? Does it embody values that we believe in? If the answer to all those questions is yes, we go ahead. Of course, a program should work well, and the instructions should be clear. The most important thing to decide is whether or not the software is appropriate for the child who's going to be using it."

Hakansson urges parents to consider the long run. "People ought to think about what their children are going to need 10 years from now. There's a tendency to say, 'I want this computer to help my child learn the basic skills.' Well, I'm not sure that basic skills are what they used to be. Children today need to know more about general concepts such as estimating, recognizing patterns, and evaluating information. It's going to be impossible to make our children learn all the specific information they're going to have to use. We want them to be able to manage the technology, to evaluate the information they get from it, and to use it in a creative way. Let the machine amplify the human being, but put the human being in charge. That's how we ought to be raising our children today." ☐

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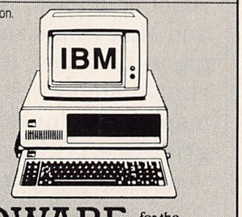

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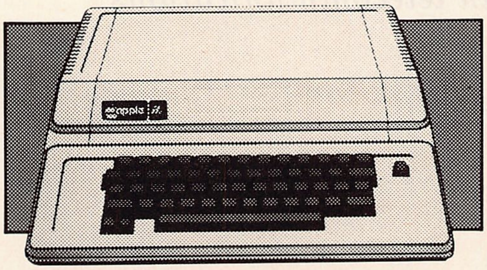

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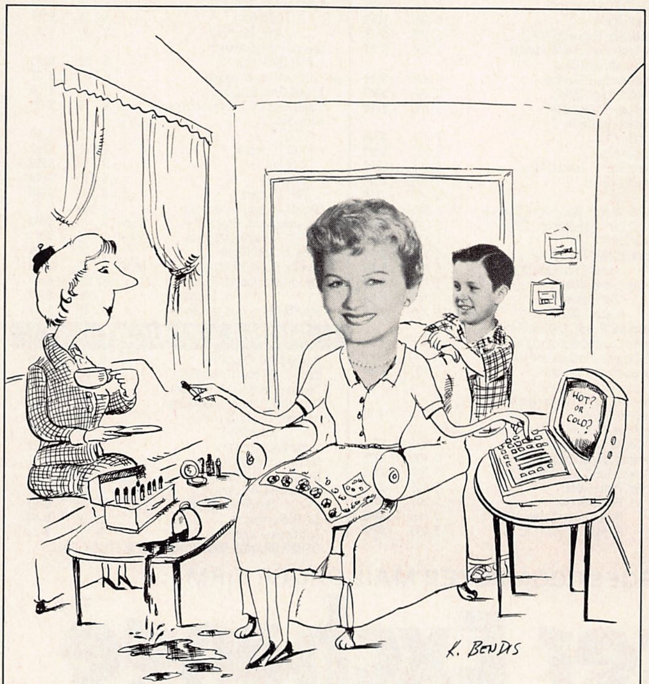
Dialing Dilemmas

Coffee on the rug, and other nagging problems in telecommunications

by Steven Levy

I was recently at a big computer show in Las Vegas, a town that has taken to computer shows with considerable gusto. Roaming along the aisles of the cavernous convention center, I came across a boggling array of telecommunications devices—modems, terminals, software packages, even telephones. (Remember telephones?) One display that particularly impressed me was the Mattel Electronics booth. Recklessly shirking an invitation to step into the parlor for a preview of the Intellivision III game console (which, rumor has it, comes with a mind-fogging attachment that will paralyze a video-game critic at 40 paces), I instead concentrated on what seemed more significant than yet another attempt to snare the chimera of arcade graphics in the home: Mattel's bid to make telecomputing a household activity.



Keith Bendis

This is a two-pronged offensive. The first involves a keyboard and modem that may be added to the Intellivision game system. The second front features Mattel's new mass-market computer system, the Aquarius. The dawning of this new age will come when people, just everyday people like those who used to live in situation comedies, begin shelling out modest sums (under $500 without modem) for complete systems including sleek white Aquarius computers, tiny printers, and audio-cassette recorders.

But Mattel doesn't stop there. The Hawthorne, California, toy company has surveyed existing computer networks and found them geared to businesspeople, professionals, or hobbyists—not the June, Ward, and Beaver Cleavers of the world. So, to reach people like the Cleavers, Mattel is going into the telecommunications network business.

"After looking at all the databases, we decided to develop our own," Mattel's Kathy Kennedy explained to me. "We'll have electronic mailboxes, and we're looking at things like home maintenance. Say you spill some coffee on the rug and want to know what to do—the Aquarius database will tell you."

What else will it do?

"We're going to see what the consumer desires."

When it became clear I wanted more particulars on this database, perhaps the first truly mass-marketed database in history, Kathy introduced me to Fred Cutler, one of the executives in charge of the product. Concerning some aspects, Fred was quite illuminating. He told me that the service would piggyback on the Compuserve network, with special procedures for easy accessing. He was enthusiastic about the possibilities of going beyond typical text transmissions—because all the database's callers will be Aquarius owners, the network will be able to send out colorful graphics

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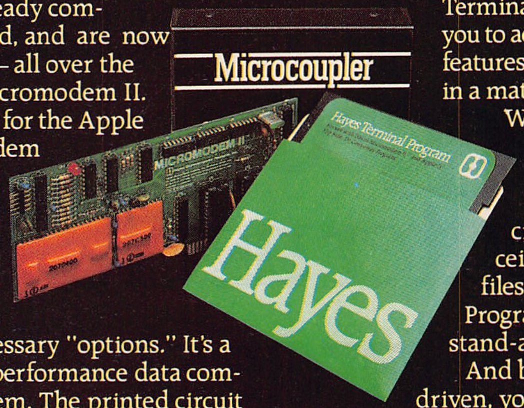

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Now there's Hayes Terminal Program, too! Developed by Hayes specifically for Micromodem II, this new Terminal Program allows you to access all the great features of your modem in a matter of seconds.

With it, you can use your CP/M,® DOS 3.3 or Pascal formatted disks to create, send, receive, list and delete files. Hayes Terminal Program is a complete, stand-alone disk.

And because it's menu driven, you can choose from a wide variety of options to set your communication parameters — as well as change hardware configuration — directly from the keyboard. It even allows you to generate ASCII characters that are normally not available from Apple keyboards, further extending your capabilities. Incoming data can be printed (on serial or parallel printers) as it's displayed on your screen.

Micromodem II is available with or without the Terminal Program. Buy your modem by itself, or optionally packaged with the Terminal Program disk and user manual at extra cost. The software is also sold separately, for those who already own a Micromodem II.

If you're ready to communicate with other computers, to access information utilities, time-sharing systems, or use bulletin boards, then you're ready for Micromodem II. Come on. Compare. Consider. Then buy.

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and games custom-made for the machine. Cutler guessed that the price for all this would be $5 an hour after 5 p.m. (less than Compuserve itself) and $18 an hour during the day.

Cutler was less certain about the measures Mattel might take to prevent billing problems. What if young Beaver takes the Aquarius to his room and runs up a few hundred dollars in access time playing the new Space Holocaust game and Ward refuses to pay?

"We haven't resolved that," Fred Rutherford, I mean Cutler, admitted. "When you buy an Aquarius modem you'll be given a password, and possibly you'll need a credit-card number to activate it. Maybe we'll have family accounts, with the family responsible for paying the bills." Another alternative, Fred reckoned, might be to assign special passwords to certain parts of the database, like games, that might tend to be addictive to certain family members.

But Fred Cutler didn't see games as the cutting edge of this new service. "We're talking about things that will be useful in the home itself. Things like coffee spilled on the rug."

That was the *second* mention of this specific domestic calamity! I pressed him to explain exactly what *would* happen if June Cleaver, whilst entertaining an Avon lady with a mug of Maxwell House, leaned over to test the lipstick and dumped the java on the wall-to-wall.

Cutler was up to the challenge. "OK, say you spill the coffee. You're concerned about it. You log on—we'll have easy-dial access—and call up the home maintenance section. You'll say 'coffee spilled on carpet.' It might ask you a few questions. Was the coffee hot or cold? What kind of carpet was it?"

"Uh," I interrupted, "how many questions do you think it would take?"

"Six or seven," Fred guessed. "Then it'll say 'Thank you,' search through possible information, then give you the answer. You log off and tend to the problem."

Fred Cutler was so sincere in his explanation that I never did ask him if he'd ever spilled hot coffee on a rug, as I had done just weeks before the computer show. I had been a guest at a friend's house, sipping a large paper cup of Seven-Eleven brew. I shifted a newspaper, the cup went forward, and I watched helplessly as the coffee raced across the table to its final destination—a murky puddle on the thick white carpet.

Not being connected to the Aquarius network, I did not turn on my computer. In fact, I was so panicked that I could barely keep from tripping over myself in a rush for paper towels. Even if I had been suitably wired, I doubt if I would have had the composure to leave the room, find the communications software, boot up the computer, and calmly snuggle up to the keyboard to call up the database and answer the questions. When it asked what kind of fibers were in the carpet, I'd have to race back and look for the label. What if in my haste I mistyped a word and had to watch as INVALID REPLY flashed on the screen, wasting more valuable seconds? And what if, just as the search of thousands of potential solutions was finished and the answer was about to appear, someone called me and my call-interrupt function disconnected me from Aquarius? I think that the trashman would be picking up a carpet that week—along with a certain low-priced mass-market computer.

By the way, for those of you who don't plan to be connected to Aquarius, let me clue you in on something I learned too late. Best thing for a coffee spill is club soda—soaks it right off the rug.

Tiny Terminals

Another thing I noticed at the show was a proliferation of tiny terminals. Some are as small as a paperback book, others are the size of a cigar box, but the idea here is to make telecommunications totally portable. Using push buttons instead of typewriter keys, these small wonders allow you to send electronic mail or enter detailed requests for certain databases. Some of the more elaborate ones, like Novation's Maxi Infone, even have tiny headsets for voice communication.

A few months ago I tried out one of these dinky terminals, the IXO TC101. Weighing slightly less than a pound, the IXO is capable of putting you in contact with the database of your choice using any available phone jack. (You can buy an optional acoustic coupler to use the IXO on phones without jacks—if you work with pay phones, this seems a must.) The keyboard has all the requisite ASCII (American National Standard Code for Information Interchange) characters on cute little quarter-inch squares. It even has a button that puts out a tone signifying "I don't know," something I wish I had on my Apple. (Actually, the key is a shorthand way of typing an exclamation point and carriage return, which in some circles is apparently the electronic equivalent of a shrug.)

The best thing about the IXO is, of course, its portability. You don't even need an electric outlet: the terminal has a thin Polaroid battery to get it started, and once plugged into a jack, it works off the phone company's power. My main use for the IXO was bringing it over to friends' houses in my briefcase. I'd tell no one about it. Sometime after midnight, I'd pull it out, plug it into the phone, access The Source or Compuserve, and call up the box scores of that night's baseball games. The responses ranged from mild astonishment to yelps of joy. Indeed, it seemed incredible that such a small piece of equipment—something no bigger than a Beta video-cassette cartridge—could hook you up to the computing power and data storage of giant mainframes, and tell you that

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Steven Levy is a contributing editor of *Popular Computing*.

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Carney Lansford went three for four!

But as I used the IXO some more, I found it less than ideal. For example, a series of bizarre beeps and snorts comes out as you log on to a system with the terminal; at first this is rather endearing, but eventually it becomes annoying. What if I want to take advantage of the IXO's tiny size and sneak out of a party and into the host's bedroom to check out a stock price? Someone's bound to hear those weird noises and wonder if I'm planting a bomb or something.

Somewhat more seriously, I can say that the one-line liquid-crystal display is much too limited for more than the quickest sessions. If you're whizzing through a series of menus to get to a certain point in a database, it seems to take forever. You *can* adjust the speed at which characters appear from painstakingly slow (two characters a second—wake me when it's over) to a full-speed-ahead, 30-characters-per-second blur that is guaranteed gibberish to anyone without a *magna cum laude* degree from Evelyn Wood Institute. And the pint-sized keyboard, however complete, makes the process of inputting text a rather tedious index-finger-pecking session.

In short, I think terminals like this one are terrific novelties and even useful to those who have regular access to full-screen terminals and would like to get some telecomputing benefits while on the move. But at what price? The IXO costs around $500, and some of these tiny terminals go for as high as $1200. I'm sure there are plenty of high-powered executives who would like to extract business information from databases at a moment's notice, but other than that category of big spenders, I can't imagine who would get his or her money's worth from the things—unless it's worth 500 bucks to amaze your friends with the baseball scores!

Problem of the Month

For the longest time, I've had a trivial yet annoying problem with Compuserve. Sandwiched between the transmission of characters would often be "waste" characters. Invariably, there would be a JMH at the beginning of a new screenful of text and some Ys, !s, and Ks at the end. Besides that, everything worked fine: I could download a long message without a character out of place. Then I'd call up a new menu and the unwelcome characters would appear again.

Wondering if anyone else shared my plight, I called Compuserve's spokesperson, Richard Baker. "Oh, *that*," he chuckled, and I knew I had an item. "That has to do with terminal parameters. As a

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matter of fact, I get those garbage characters on my terminal at home. It's easy to stop it."

The problem, it seems, is that Compuserve configures itself differently for different kinds of terminals. Certain characters it sends out might clear the screen of a TRS-80 but show up as unwelcome intruders on an Apple. I brought this on myself, I was told, when I first logged on to Compuserve. Apparently (though I have no recollection of this) I replied that I was using a teletext-type terminal instead of "other." For *that* I got punished? Oh well.

I learned that there are two possible solutions. The first is to add, right after I enter my identification number when logging on, the characters :TTY. This tells Compuserve that, during this session at least, you're on a plain old vanilla terminal. If you ever have occasion to access Compuserve from someone else's terminal, it might be a good idea to log on that way.

The second (and more permanent) solution is to Go to page CIS-4 the next time you log on. You can then reset your terminal parameters to "other" or, if it applies, tell the service you've switched to another terminal that needs special kinds of transmission (like the VIC-20 with modem).

I tried it, and it worked.

BRS Update

A few months ago, I wrote about the lack of low-cost databases, noting that a couple of online services were just getting into that field. One was Bibliographic Research Services, which had just announced a $6-per-hour version of its regular, much more costly assortment of abstracts and references on various subjects. The new service, BRS After Dark (named for its access hours, which are after businesses shut down), would also provide electronic mail, software downloading, and a swap service to allow users to do some electronic bartering.

I was disappointed that, three months after the service was open for business, nothing was available beyond the databases. Especially frustrating was the initial menu, which offered roughly seven choices, most of which yielded only a message that this or that feature was coming up in the future. I suspect that BRS's ongoing competition with Lockheed's Dialog research service caused it to go online sooner than it had planned (BRS announced After Dark's opening the same day that Dialog unveiled its own low-cost offspring, The Knowledge Index). After Dark spokespeople assure me that by the time you read this, the mail and software services, at the very least, will be up and running.

On the other hand, I was terrifically impressed with the power of BRS's search features. Almost two dozen databases are available, and while many are rather specialized (one is devoted solely to writings on bilingual education), others, like Books in Print, would help seekers of even the most general information.

I used After Dark to look up information on a government project that had come up in a story I'd been doing. I knew no books had been written about the project, and some of the principals had been reluctant to discuss it with me.

So, after calling up After Dark's NTIS (National Technical Information Service), I typed in the name of the project and within seconds I was informed that 67 citations existed. That was too many to look through, so I typed S to continue the search and asked After Dark to look for "1 and history." This meant to carry over the first request and pull only those citations that also mentioned history. I was hoping that one of those 67 citations would be a long study of the project.

That second request limited the field to two citations. I keyed in P to get the initial citation, and eureka—it was a 183-page history of my project. It was not officially published, but when I called the

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company that prepared the study, they agreed to send it to me without charge, no questions asked. I have no idea how I would otherwise have found this report. My access time at that point was under five minutes; finding this invaluable nugget had taken less than a dollar on the online meter.

After Dark Complaints

Naturally, I then wanted to get that second citation, so I pressed P again. To my dismay, the first citation reappeared. I rechecked the documentation and could find no command other than P, S, D (to switch to another database), M (to go to the main menu), and O (to sign off). There *had* to be a way to get the second citation. I got around this roadblock by giving the search command and making my previous request, amended by "not" the title of the first citation, but that technique couldn't possibly be applied to a longer list.

To get to the bottom of this, I called (collect) the number of BRS headquarters in Latham, New York. A friendly support person heard my plight and told me that a command to see the next citation certainly did exist. "Just hit the ENTER or RETURN key," she told me. I asked if perhaps she could tell me where this pivotal command is given in the documentation. We went over the clearly written instructions together, and she concluded sadly that this was indeed an omission. I later learned that if I had identified myself to the service as a telecommunications virgin, an on-screen message would have supplied me with the necessary command. Who knows?

The only other complaint I have with BRS After Dark is that you always have to be using one specific database; you can't, for instance, tell the service to find all references to Nolan Bushnell (founder of Atari) regardless of which database they're on. When I searched for Bushnell comments I used three different databases, conducted the same search three times, and found citations for different articles each time.

I know the explanation for this: each database has a different arrangement with BRS, its own royalty rate, and its own online rate to the consumer (in addition to After Dark's $6-per-hour base). It's much more convenient for BRS to make us go through databases one by one. But as the market for online services grows, look for these kinds of arrangements—convenient for companies, awkward for users—to change. Those services that don't make it easy for us impatient and less-than-thorough folks just might get lost in the shuffle. To the user-friendly will go the spoils, just as it should be. □

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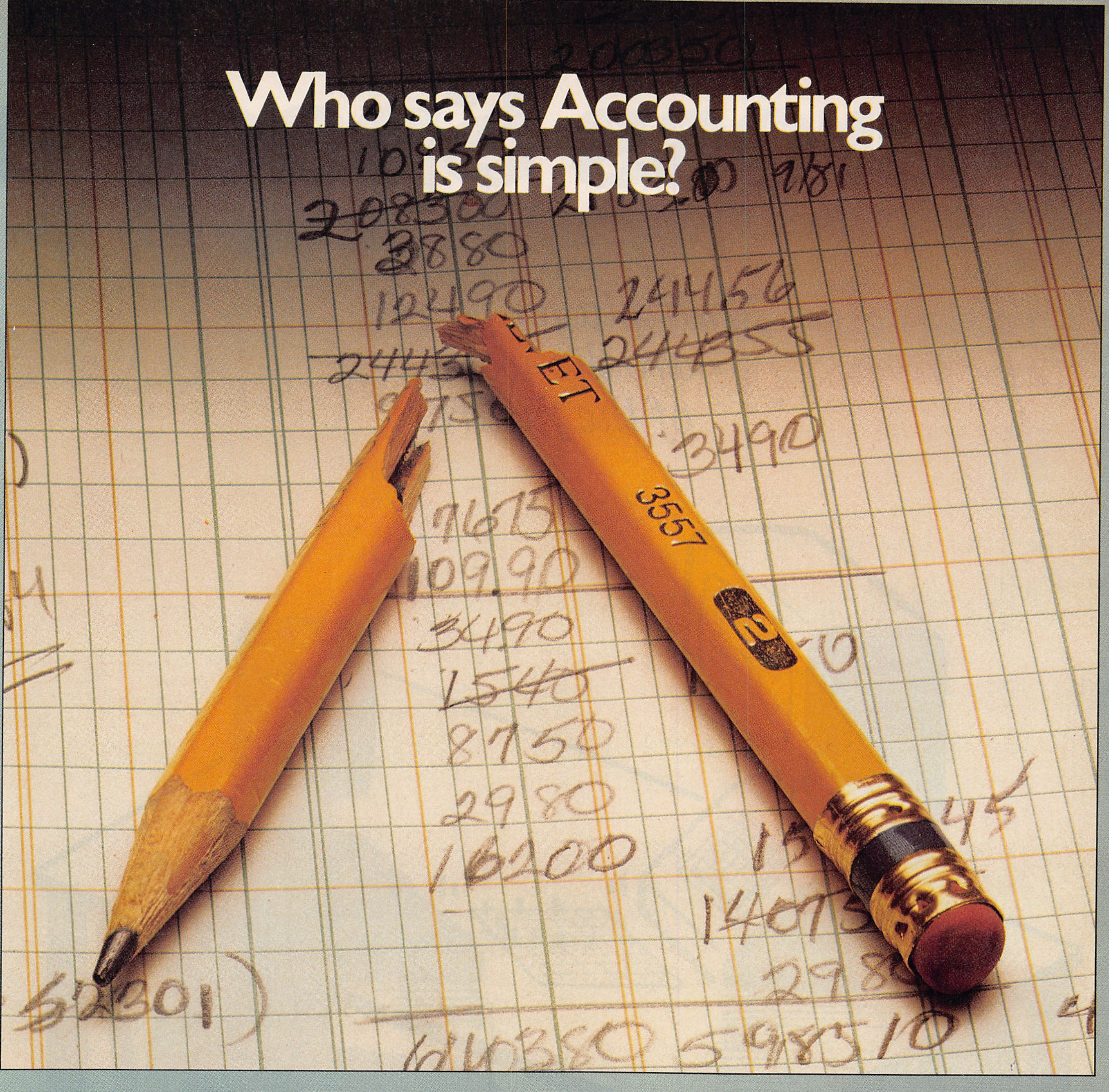

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Across Space a

Multiplayer games
are the wave
of the future

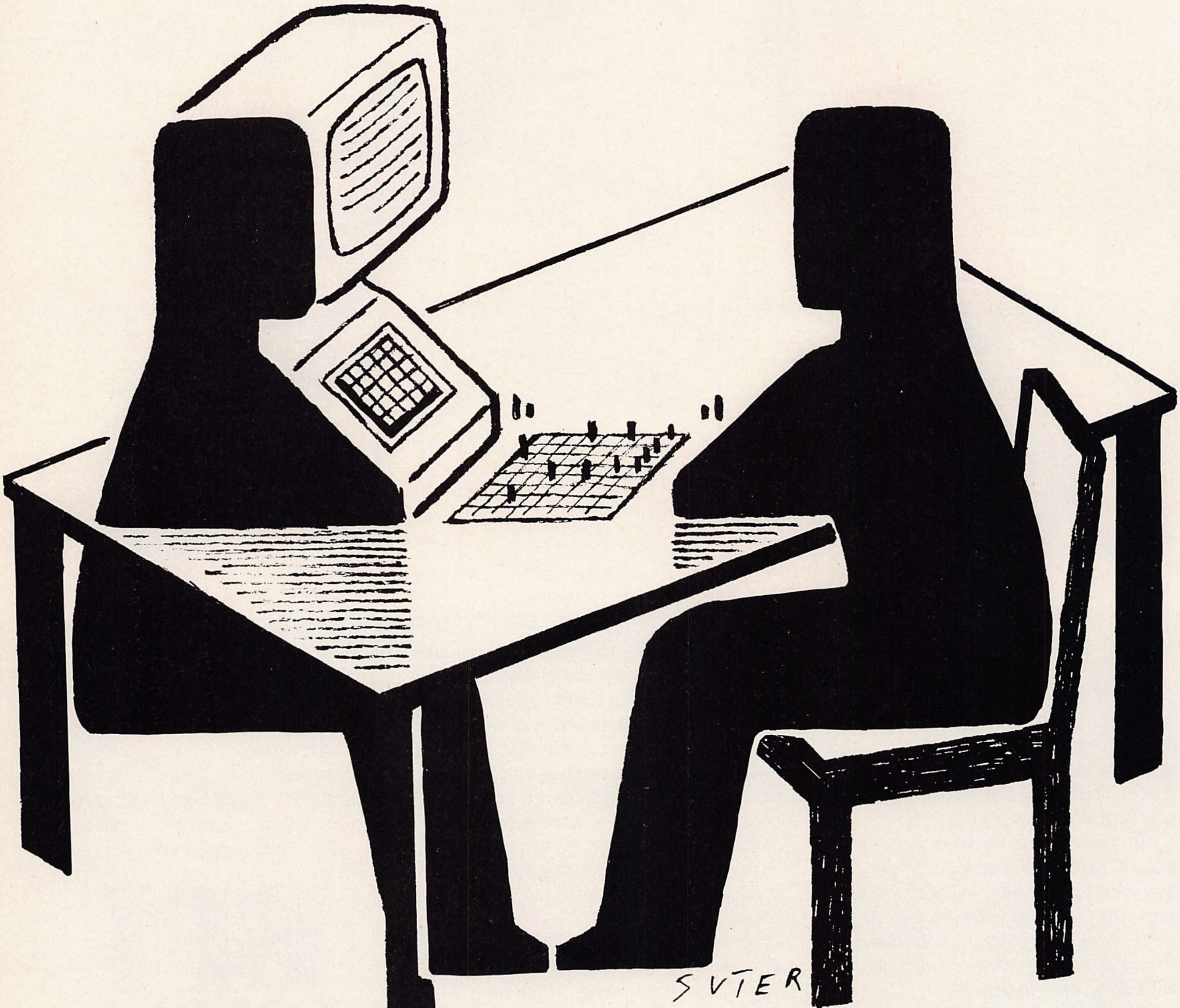


Illustration by David Suter

nd Time

by Rachael Wrege

Remember how it felt when you were sick or being punished and all you could do was play solitary games alone in your room? That's what single-player computer games remind me of. The microcomputer and a copy of Alien Attack are entertaining diversion when insomnia strikes at 4 a.m., but give me a game I can play with someone else, give me a real live human being to match wits with, and then you're talking fun. Better yet, give me a computer and a couple of people to play with—and you're talking *great* fun.

Others must feel the way I do because multiplayer games are becoming more popular with and available for computer aficionados. Now you can transcend the limits of geography and time by playing with others across the country on one of several round-the-clock networks and information utilities, or gather friends and head down to an arcade-style multiplayer game, or play a game by mail that lasts several years and is tabulated and refereed by computer.

Network Games

The granddaddy of interactive multiplayer games is the Plato educational system created by the University of Illinois, Champaign-Urbana. Plato has been sold to Control Data Corporation, but the university still maintains the original system with 1200 terminals scattered around campus, across the country, and at international sites. Some 600 people use the Plato system each day, and many of them play the hundreds of games that reside on the system.

One of the oldest and simplest interactive games in Plato is Dogfight. According to David Frye, head of computer operations for the university, the game consists of two planes trying to shoot each other down. The computer terminal serves as a cockpit for the players, and arrow keys move the planes. A more complicated game is Empire, "a Star Trek-type game," says Frye, that can involve up to 30 players in 4 teams. The goal of each team is to conquer the universe by using ships that fly and attack as well as ships that transport armies. Team members must cooperate and coordinate efforts to win. Games have been known to go on for days although winning is possible in a few hours if "there's literally no competition from the other teams," says Frye.

The Plato games were designed by a number of people involved with the system's continually changing architecture, and as computer science students move through their academic stint, they add more games year by year. Most of the games began as experiments "to test the limits of the system," Frye adds. Plato runs on Control Data's Cyber 73 and 6500 computers and uses plasma terminals with orange and black screens and high-resolution graphics.

By far the most popular game on Plato is Dungeons and Dragons, a role-playing adventure with no end. The game has several variations, and most students play one of two versions: Oubliette (French for "dungeon with only one door") or Avatar. Each has a maze the players wander through in the guise of characters searching for treasures and adventures.

According to Tom Tryboski, a student at the university who plays 20 hours a week, players can choose from several different classes of characters—thieves, magicians, fighters, and clerics. Because the maze has a number of levels (most players create maps from their explorations) and because players are likely to be set upon by all kinds of dragons and monsters, it's better "to go exploring in groups," says Tryboski. "Parties that mix different strengths are the strongest. It takes some time for players to get the hang of the game, so it's safer for beginners to tag along with other people." Up to 60 players can explore the maze at any one time, and as they move through the game, they're awarded points for experience, weapons, and treasures. "Very rarely do characters get to be as strong as they can be," says Tryboski. "But if you have a very strong character, you can roam around the maze forever, help other people's characters, and work on different characters for yourself."

Tryboski has been playing Dungeons and Dragons (which is also played across the country on paper as well) since he was introduced to the adventure by a friend several years ago. "It's a very social game," he explains. "You're not playing alone—there are other people in the game, and the competition comes in when you're trying to make your character stronger and more experienced than someone else's."

Tryboski also plays Empire, occasionally for 10 hours at a time. "It's a great way to meet people because you can exchange comments over the computer. Playing against other people is more interesting because there are more variables. People have different strengths and weaknesses, and you can tailor your strategy to things you know about them. There's also the tactical part—you have to be able to type fast and get your commands in when you're firing directly at someone. And then there's the diplomacy angle—you can make alliances against others when they're too strong to beat on your own," he says.

In addition to playing the game, says Tryboski, users leave each other messages in what's known as "note files" on the system. Sometimes the program's designers also include notes because the games are constantly changing as the programmers fine tune and experiment with them.

While you must have access to a Plato terminal to join in the multiplayer games on the system, anyone with a microcomputer and a modem can dial up Compuserve (5000 Arlington Centre Blvd., Columbus, OH 43220, (800) 848-8199 or (614) 457-8650)

Rachael Wrege is the West Coast editor of *Popular Computing*.

and play the utility's blockbuster, Megawars. While Compuserve has several multiplayer games, including Fastermind, Real-Time Trek, Decwars, and Spacewars, Megawars is the second largest revenue producer for the company (outselling the stock quotes and news wire).

When you dial up to play Megawars (with a hookup fee of $5 per hour), you choose to join either the Colonists (the good guys) or the Kyrons (the bad guys), and you're given a rank depending on your experience with the game. Beginners start out as lieutenants and get spaceships with high shield power and low firing capabilities to give them protection from opponents until they become more skilled. As the game proceeds, players are promoted and acquire faster, more powerful ships and weapons.

Whichever side of the game you choose to play on, your goal is to gain control of the universe by capturing planets and annihilating the enemy. Players can use subspace radios to communicate with allies or foes and use tractor beams to tow damaged sister ships to safety. You also have phaser banks, deflector shields, ship computers (for navigation), and a bevy of other devices to fight with.

The time it takes to complete a game varies, says Compuserve's editorial director, Richard Baker. "There's a lot of strategy in the game, and if the forces are unbalanced, the game can be over in less than an hour. If you're pitted against equally skilled players, the game can go on for hours."

Up to 10 players can join in Megawars at one time, and thousands play each week. If you dial up to play and no one is involved in a game, you can play the computer, says Baker, which takes the role of the Acheron, a monster whose greatest desire is to throw you into the black void of space. The Acheron used to be a regular feature in Megawars but now appears only if just one person is playing the game. "Users were upset about the Acheron because he would start attacking a player involved with fighting another player. Now he's just practice for people waiting for others to join in." If you don't want to fight the Acheron, you can go to the computerized bulletin-board service on the network and ask if anyone's interested in a game, leave a message on the bulletin board for another date and time, or send an electronic message to a particular player.

Creating a Universe

You may not have heard about multiplayer games before for one very good reason—there aren't many around. Interactive computer games are extremely difficult to design. Not only do these intricate games contain more variables for programmers to deal with, but the speed at which the games are played is hard to manipulate.

According to Nancy Beckman of The Source, multiplayer games will not be available on that system until 1984. "One of the reasons we're not jumping into it is because most users access us at 300 bits per second, and that's not fast enough for us. We're waiting until more people have the capacity to use 1200 bits per second," she says.

Russ Ranshaw, a Compuserve program designer and the chief implementer of Megawars, says it takes skill, hard work, and "praying" to create an interactive game. Synchronous games (those that follow a rigidly defined set of rules) such as chess, checkers, and bridge are the simplest. "Asynchronous games like Megawars are far more complex," he adds.

"You have to design how the game looks to the players and how you are going to help them into it—help them develop enough skills to play it. Then you have to design the rules of the game and decide how players are going to communicate, if indeed they are," Ranshaw explains. "The chief problem is controlling what each player does at the same time."

Because a lot of action can be going on all at once in a game like Megawars, the computer has to have some way to control chaos so that play can have some semblance of order, Ranshaw says. At Compuserve, the major tool for keeping order is the ability to share memory between parts of the larger program. Each player communicates with a master program that tells the players via their own terminals what has occurred. In addition, the players share both a read-only part of memory (as protection for the program) and a segment in which they can communicate with one another. It is in this shared section of the program that variables of the game exist. In other words, says Ranshaw, this is where the action takes place with the rest of the master program serving as a backdrop and controller for the game. A third segment of the program is local to all players—it stores the information important only to a single player, such as an individual's score.

Players enter their commands in the shared part of memory. Says Ranshaw, "We use a queueing process. A player queues up to enter a command and then is ousted so another can make a command." In Megawars, a monitor controls the command process so players are not aware that they're not making simultaneous commands.

Game designers must also consider what will happen when a player does something unexpected. For example, what happens if a player quits the game in midstream? "We must have a way to deal with the ships and weapons he's left lying around. The monitor cleans up after him, releases the queue if he was in the middle of a command, and avoids crashing the game," Ranshaw says.

Every game also includes a number of optional features. The game doesn't need these options to function, but they make the presentation of events to the players easier, says Ranshaw. In Megawars, for instance, a player can choose to have the text explaining events in the game be long and involved, shortened

—or for experienced players—reduced to symbols.

That particular example brings up another point, Ranshaw says. "When we design for an information service like ours, we try to minimize our operating overhead. We have to keep the use of memory as low as possible and minimize use of the communications channel but also keep the player interested and connected as long as possible. Megawars is, unfortunately, a memory hog."

Designing a multiplayer game is much like creating your own little world, says Ranshaw. "At various times in designing, I thought I knew what it was like to be God—you have to keep everything running smoothly and interacting all at once." A universe takes a while to create as well. Megawars was acquired from an outside source and took Ranshaw three months to implement and run on Compuserve's Digital mainframe computers. To create such a game from scratch, he says, would take an entire year with a designer working on it full-time.

Thrills, Challenge, and Fun

At Compuserve, Megawars is bested in revenue production only by the company's computerized bulletin board where users can electronically communicate on the spot. Ranshaw thinks he knows why. "People are exhibitionists," he says. "They like to communicate but sometimes only from behind a terminal where they can wear a mask. The alter egos they have come out, and psychologically it's very satisfying."

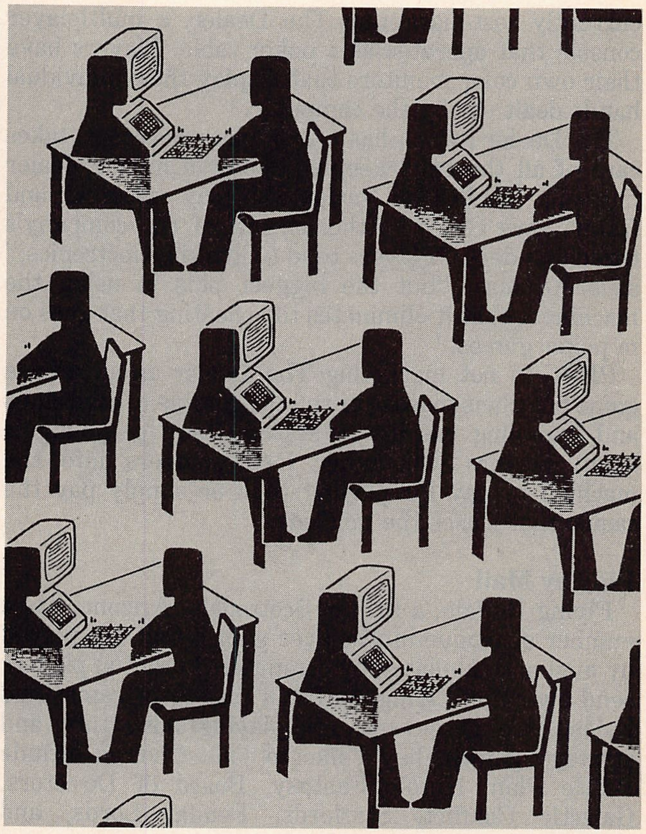
Dr. Madeleine Gross, an experimental psychologist with Sigma II Research Associates in Sunnyvale, California, agrees. She says that people like to fantasize and role play. Games let people explore alternative ways of being, Gross continues, and they're safe because they're not for real. "Violence in these kinds of fantasies is even safe—it's stylized."

But the compelling draw of the games, says Gross, is interaction. "People are social beings and they like to interact with one another. The computer simply provides a context for what we've been doing for centuries—playing."

Frye, at the University of Illinois, thinks playing with other people demands more than playing with just a computer. He says, "You're pitting your skills against another human being instead of against a machine, and you get a better comparison of your efforts. You can't blame the computer for being faster—you can only look at what you've done compared to another player."

Multiplayer Arcade Games

Those who like the lights, sounds, and thrills of an arcade game and who have been stymied playing solitary games may soon find themselves seated at a console playing against opponents just across the computer. Under license from Paramount Studios, Simutron, a company in Vista, California, will this year start construction on Simutron Tournament Centers. Inside will be a Star Trek console that will handle 16 players at a time, each with his own set of display screens. According to Dave Jenkins, Simutron's marketing director, each player will have 4 high-resolution 64-color graphics monitors, quadraphonic sound effects, an intercom allowing communications between players, and computer-verbalized commands and instructions. As operating officers on the Starship Enterprise, players can check navigational information, damage reports, and other status items.



At various times in designing, I thought I knew what it was like to be God. You have to keep things running smoothly and interacting all at once.

"Competing against the computer is getting old," says Jenkins. "Our tournament centers will be competitively priced with arcades, and players will purchase time in 15-minute increments. We'll also hold annual Simutron tournaments." Jenkins will not talk about the technology used in the centers. "It's hush-hush until we get them on the market," he adds.

Along the same lines, Pacific Electronic Sports Corporation (PESC), a company in Hayward, California, is currently test-marketing The Dealer, a multiplayer console that operates as a poker table. Players have their own color monitors that display their individual hands dealt out by the computer.

The Dealer (which has a Z80 microprocessor) takes care of all the housekeeping chores a human dealer normally handles but makes the play smoother and faster, says George Athenas, one of the company's three founders. "Players tend to like the electronics," says Athenas, "but the biggest plus in using the machine is that it eliminates the cheating that goes on in poker games."

PESC is not marketing The Dealer as an arcade game but plans to lease or sell the console to card clubs and gambling casinos in states where gambling is legal. Players will either feed quarters into the machine to pay for playing time or simply pay the casino that leases the machine.

Play by Mail

Flying Buffalo, a firm in Scottsdale, Arizona, has a number of unique multiplayer games that are played by mail and tabulated by computer. Potential players send away for Flying Buffalo's catalog of games and choose one of several role-playing adventure and strategy games they'd like to join. Choices include Battle Plan, Heroic Fantasy, Board of Directors, Galactic Conflict, Starlords, Feudal Lords, and Starweb.

For a $10 initial fee, players receive rules and the game plan and choose the type of character they want to be. In Starweb, for example, the firm's most popular game, players can be empire builders, merchants, apostles, berserkers, and pirates. Depending on the role you choose, you're awarded points for achieving certain goals as you move through the game. Apostles gain points by converting others to their religion, berserkers get points for destroying things, empire builders must capture planets and colonize them, and merchants must sell and distribute goods.

Flying Buffalo places up to 15 people together in a game and serves as a message center between players (the service is now coordinating 295 games with 3100 players around the world). According to Rick Loomis, founder and president of the company, most players immediately give out their real names and telephone numbers and contact one another directly to make alliances and negotiate.

Players send their moves to Flying Buffalo either through the postal service, across the information utilities (both The Source and Compuserve), or via phone to the firm's answering machine. Players pay a fee (usually $1 to $3.50) with each move about every two weeks to a month. The firm's North Star Horizon or Raytheon minicomputer tabulates the moves and sends new printouts to the players.

According to Loomis, games can take two to three years to finish, and some never end. "I play," he says, "because I like really complicated games, and I like to spend hours pondering all the possibilities. I don't like playing opposite an opponent who's sitting around fidgeting and waiting for me, and I don't like to wait for anyone else. This way, I make optimal plays without anyone pressuring me."

Even though he doesn't like to wait, Loomis adds, he'd rather play against a person than against a computer. "With a computer you're just playing a puzzle, trying to determine how the computer is programmed. In a multiplayer game, you're making secret deals, convincing people you'll be an ally if they don't attack you, and meeting all kinds of people. You'll come across clever ones, trusting ones, stupid ones, some who will never break an alliance, some who will stab you in the back at the first chance."

Flying Buffalo players are motivated by the strategic nature of the games, says Loomis. Most do not own their own microcomputers and figure out their moves by pencil. Players are also responding to a lack of adventure in their own lives, he adds. "The people who study law all day or go to work in a CPA's office don't get the sense of adventure they want. In the games, they can be swashbuckling heroes and with one bright idea can save all their friends. They can outwit others and add a little danger to their lives."

Games of the Future

According to Compuserve's Ranshaw, multiplayer games are too lucrative for companies to ignore. Megawars, he says, is just one release in what's planned to be a series. The service is currently creating a number of programming tools for outside developers to use for future games.

Ranshaw also envisions two-player games such as chess, checkers, and backgammon (which Compuserve is working on now) that will include an observer mode. "You could have national tournaments going on, and groups watching and playing from Nova Scotia, Miami, New York, San Francisco, and wherever—and no one would have to leave home to do it. Think of how much people would save in travel costs—people could gather around their own terminals for $5 an hour instead of flying to one central location," he says.

Ramon Zamora, an author and expert in recreational and educational computing, wants to make interactive games even more inexpensive and accessible through local networks. "Everyone could dial in from one area code. In fact, we've tried something like this on a local electronic bulletin board, and we don't think it would be too expensive to carry out."

And certainly with the popularity of today's arcade games, multiplayer arcade games like Simutron will give "the current ones a bit of competition," says Jenkins.

One thing's for certain. Being sent to your room with only a microcomputer to play with will be a lot more fun in the future. □

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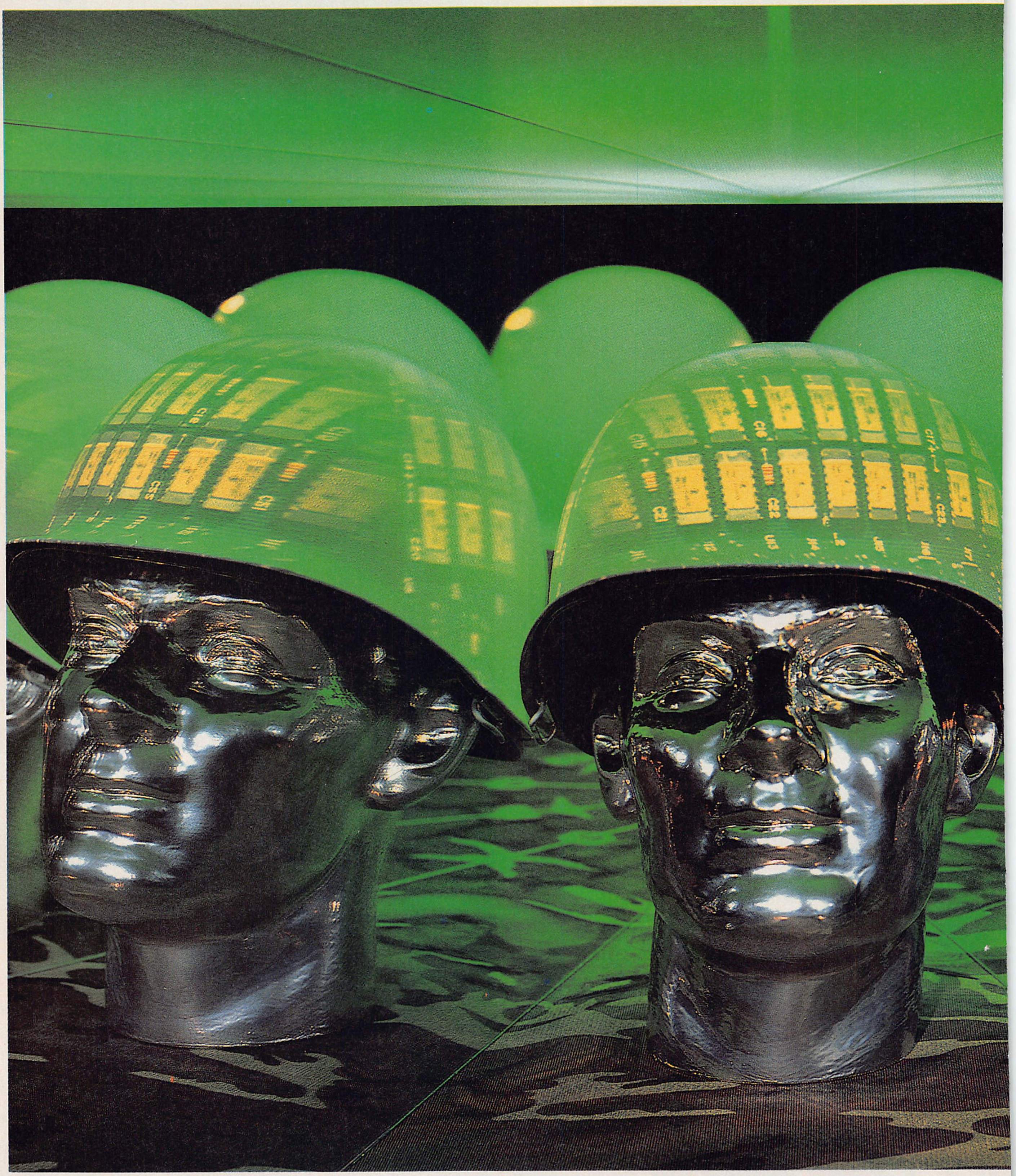
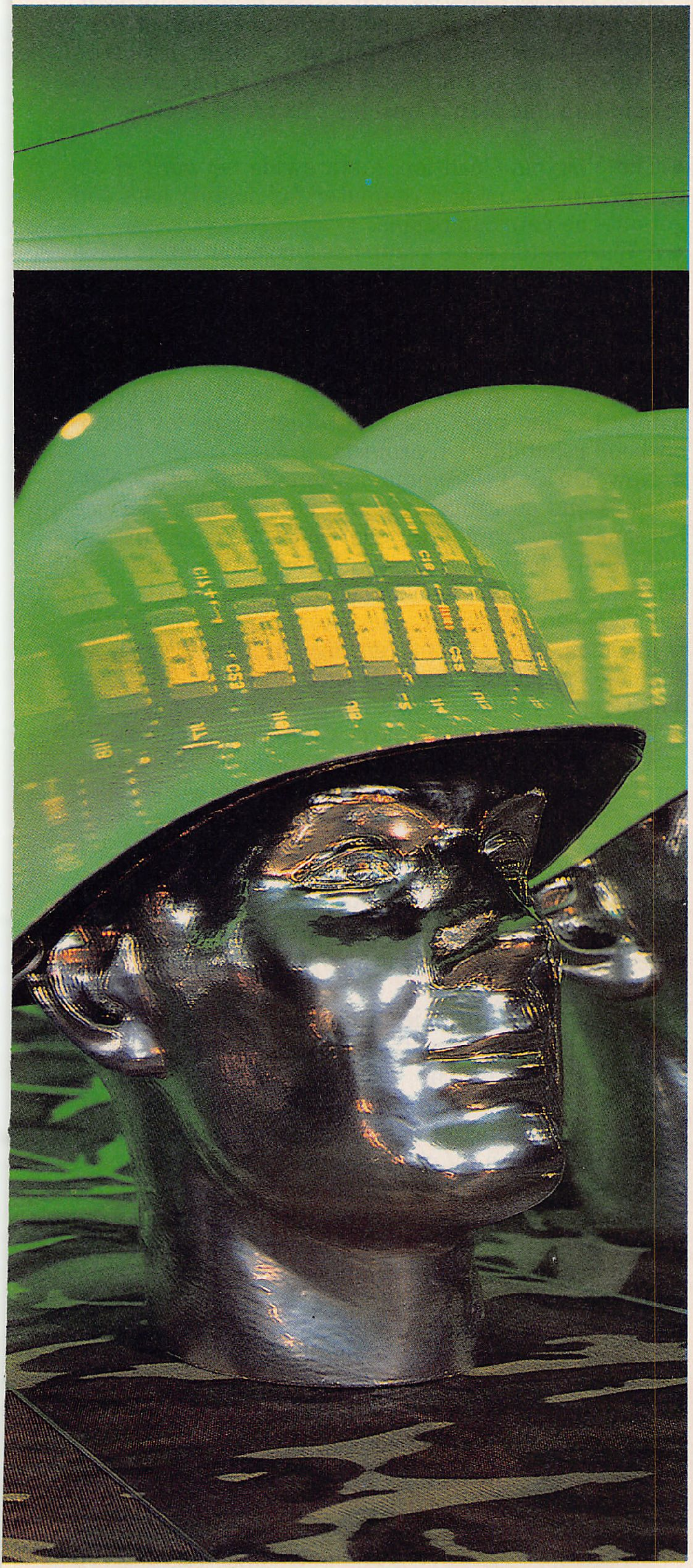


GUERRILLAS

by A. Richard Immel



■ A best-selling author, his wife, and neighbors battle the U.S. Government to a standstill over a proposed timber cut that would denude parts of their scenic little valley in southern Oregon.

■ A national environmental organization blocks a $5-billion power plant project and successfully prods utility regulators in five states to reorder their priorities by putting conservation and alternative energy sources ahead of new power plant construction.

■ A rural refugee from the city, irked by a speeding ticket from a radar-wielding country cop, proves that the radars used by police across the U.S. exceed microwave safety limits established by the federal government.

By themselves these events aren't particularly earthshaking; little guys have been rattling the establishment's cage for years, and once in a while they even win. But there's another common thread here that couldn't have existed more than four or five years ago: in all of these cases the little guys turned to *microcomputers* to even the odds. None of them, in fact, would have had a prayer without the new technology.

A. Richard Immel is a contributing editor of *Popular Computing.*

Photograph by Paul Avis

Author Richard Bach used his Apple II computer mainly as a word processor in his fight with the Bureau of Land Management in Oregon. "It was absolutely indispensable," he says. "We never could have written the things we had to write without it."

A homebrewed computer model of energy use was the only feasible way for the activist group known as the Environmental Defense Fund (EDF) to stand up to the utility companies and their voluminous and expensive mainframe computer analyses. "The idea was to rub their faces in their own numbers," says Dan Kirshner, EDF's economic analyst.

The battle over radar was a personal feud for Paul Lutus, the highly successful professional microcomputer programmer who developed Apple Writer, Graforth, and other best-selling software. Despite its insignificant scale, though, Lutus's battle illustrates the computer's potential for a broader social function. A microcomputer may be used to augment your own resources in what Lutus calls "computer activism."

THE COMPUTER AS SOCIAL GUERRILLA

Indeed, one of the more important aspects of the information revolution we hear so much about may not be a personal computer in every home, the automated office of the future, or even so-called computer literacy for our children; the most important thing may be the ramifications of the computer as social guerrilla.

Socially active computing is a departure from most previous antiestablishment computer activity, which has tended to be either destructive or quixotic. Until recently we've seen either outright sabotage by employees or terrorists with axes to grind or the meddling of sometimes playful, sometimes disgruntled individuals quietly burrowing into monolithic mainframe computers at universities and corporations. This sort of sabotage has been the work of expert programmers—known as "hackers" in the trade—who have the skill and know-how to break into large computers and roam around electronically, erasing and changing data or sometimes just leaving a "Kilroy was here" mark as a sort of electronic vandalism.

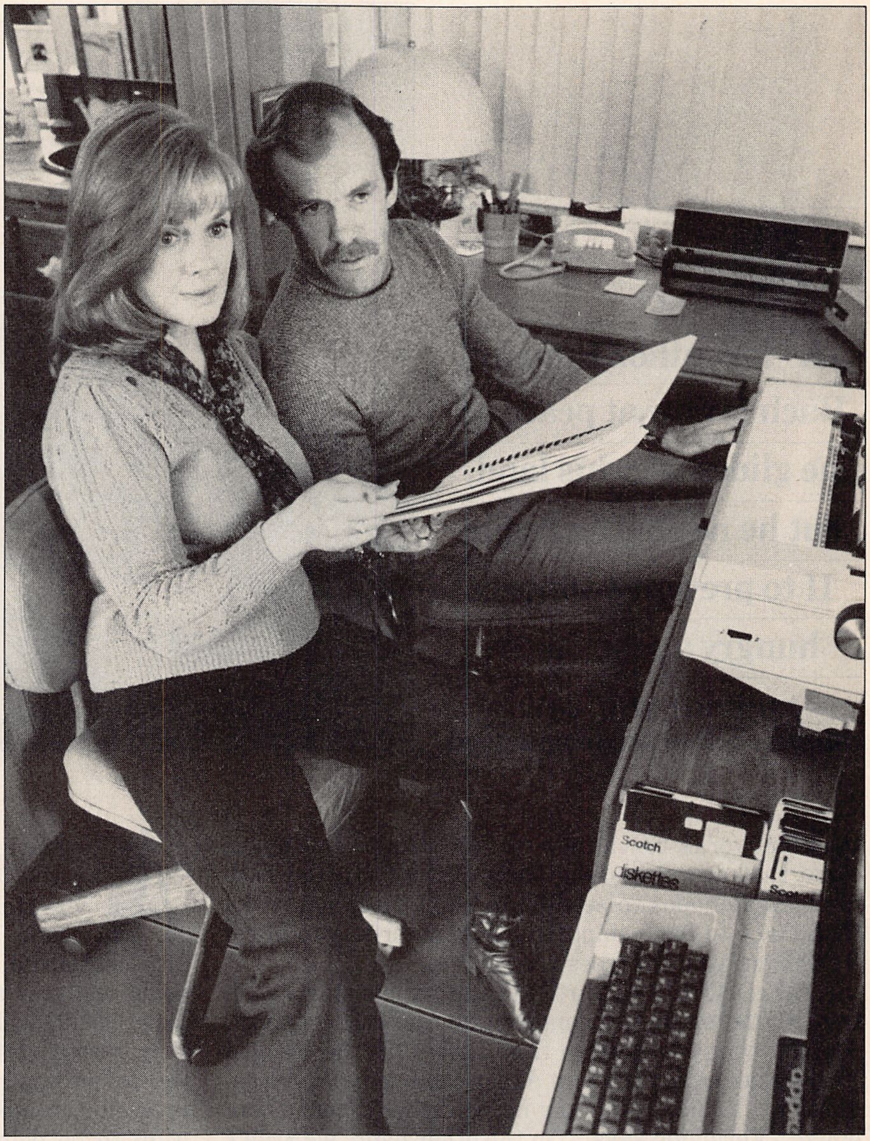
But now legitimate political and social activists of all stripes are increasingly recognizing the power a microcomputer can lend to their efforts to achieve change. Groups and individuals from Alaska to Atlanta and from Buffalo to Burbank are beginning to see how their Apples, PETs, TRS-80s, North Stars, and Vector Graphics can help them regain control of their lives and the environment we all share. They're talking to each other on their machines and plugging into commercial databases or setting up their own; they're writing letters to congressmen, they're publishing political-action newsletters, and in some cases they're even making their *own* analyses of government and corporate figures, no longer letting the institutions intimidate them with "official" results spewed out by basement-dwelling mainframe computers.

Nobody really knows how much grass-roots computer activism is going on out there, and much of what is happening is tentative. But many such endeavors are off to a good start, and the idea is beginning to spread like Pac-Man. Consider this cross section:

- The Virginia Coalition, a statewide network of action groups, is using a computer for mailing lists and get-out-the-vote campaigns.
- A Washington state group has formed an alternative Grange called Tilth that offers farmers agricultural information through a microcomputer network.
- Neighborhood community groups in Buffalo, Chicago, Denver, and Atlanta are using microcomputers to set up job-skills banks, to fight discriminatory lending practices, and to get funds for neighborhood rehabilitation projects.
- New York's Telecommunications Cooperative Network is one of a mushrooming new breed of service bureaus that provide a wide range of nonprofit and community-activist groups with various computer and telecommunications services such as discounted equipment, cheap rates for computer timesharing, electronic mail, and teleconferencing. "Demand is greater than we expected," says managing director Bob Loeb. The Coop is eyeing plans to expand nationwide.
- The Disarmament Resource Center, an umbrella organization for some 30 peace groups in northern California, has created a microcomputer network called Peace Net that offers electronic mail, a shared database of antiwar materials, and comprehensive administrative service to coordinate antiwar activities. "We believe technology can be redirected to serve *our* needs," says director Martha Henderson. "We want to use it directly in the work of peace."

Why all of this computer-inspired activity? "It's a great equalizer," Steve Johnson says of the microcomputer. Johnson, a young Oregon researcher who runs Portland's Rain Resource Center, a clearing house for community resources information, has been keeping tabs on grass-roots computing for some time now. He reports a surge of interest in microcomputers over the past year, for which he cites several reasons: more people know how to use computers, prices are lower, and the notion of microcomputers as "hobby" machines is changing. Perhaps even more important, he thinks, was the 1980 federal election. The computerized campaigns some conservative groups used to target candidates for victory or defeat impressed many politically active people. "It brought home the power of the computer as a tool," Johnson says.

Another factor in this growing use of computers is the parallel phenomenon of computer professionals shedding their apolitical pasts and becoming involved



> **What the Bachs and their neighbors did was impressive because they came off the street, so to speak, with no computer background.**

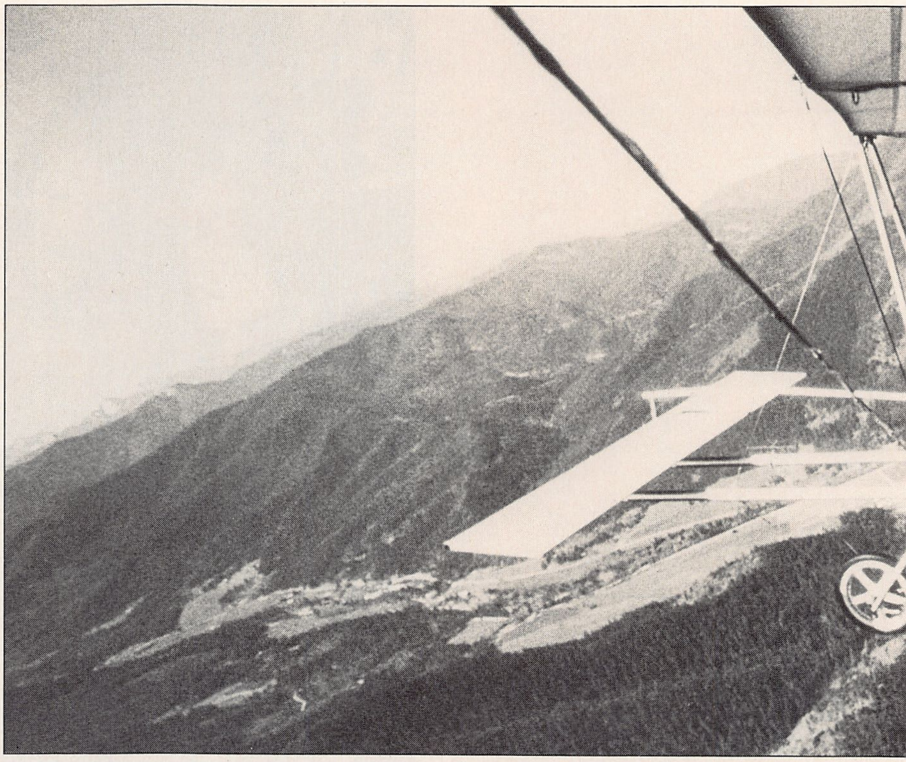
in social activism. Laurie Foster, the spark plug of Peace Net, is a good example. A professional developer of minicomputer systems software, Foster says she was galvanized into action by a speech given by Helen Caldicott of Physicians for Social Responsibility. (Caldicott is the Australian physician who has been protesting nuclear bomb tests in the Pacific Ocean.) Foster donated her services to get Peace Net organized. She's drawn up an elaborate analysis of the Net's software and hardware needs and is accumulating whatever she can beg, borrow, or steal. "I don't have a history of activism, so when *I* get involved, you know people are really coming out of the woodwork," she says.

Computer engineer Lee Felsenstein, designer of the Osborne 1 portable computer, is another active professional. Felsenstein is one of a number of hardware and software engineers belonging to a Berkeley, California, group called the Community Memory Project. To give computing power to people who wouldn't normally have access to computers, Community Memory is developing a system of free computer terminals to be placed in bookstores, laundromats, and other public locations. The project is being financed in part by Pacific Software, a commercial venture that has developed and is now marketing a relational database called Sequitur for mini- and microcomputers.

So far microcomputer manufacturers haven't gone out of their way to encourage the kind of computer activism that has a political edge to it, but this too may be changing. Through its public affairs department, Apple Computer Inc. has begun to donate equipment for computer communica-

Photograph by John Woolliscroft

Author Richard Bach is now at peace as he glides over his land, but he needed an Apple II to prevent a timber-hungry agency from marring the view.



tions networks to various worthy groups, including some that are promoting social change. In the first year Apple hopes to seed 20 to 25 of these networks with three to five computers each, according to Mark Vermilion, who oversees the project.

What constitutes a worthy group? Apple starts with the IRS definition of a nonprofit, nontaxable organization and whittles it down from there. "If the Radical Vegetarian League of Ann Arbor came to us with a request for a microcomputer network, we'd turn them down," Vermilion says. "On the other hand, we aren't going to limit ourselves to totally safe projects either. Apple Computer is an adventurous and progressive company." Vermilion says he'd like to make at least some grants to politically or socially active groups involved in human-rights causes and to "certain types of peace organizations if they're largely educational and are addressing needs for citizen awareness and conflict resolution.

"We're obviously going to stay away from groups that would be inappropriate for the corporation to back, but we will be in the forefront when it comes to helping groups whose aim is to benefit communities in innovative ways," he says.

Apple and its fellow sponsoring companies—Hayes Microcomputer Products, Software Publishing Corporation, Southwestern Data Systems, Tymshare, and Visicorp—recently supplied $35,000 worth of computer equipment to help eight community organizations set up communications networks.

As much as computers have been taken up by activists throughout the country, it would be a mistake to assume they have won over the hearts and minds of the entire activist community. Indeed, a strong current of ambivalence about using the new technology runs through some of the more ideologically oriented groups. On the one hand they recognize the utility of microcomputers, but on the other hand there's resentment over unresolved problems created by computer technology. "We don't want to be doing public relations work for the computer manufacturers," says Marcy Darnovsky, who is a member of the Community Memory Project and is also active with the Abalone Alliance, an antinuclear-power group.

"Computers are being developed for things we don't like: they're making jobs dull or eliminating jobs altogether, they're collecting information about people, and they're being used by the military to kill people," says Darnovsky, who also edits the *Journal of Community Communications*, a counterculture magazine that publishes critical analyses of the social effects of technological advances in communications. "In terms of the disarmament movement people need to be aware of these negative aspects of computer technology," she concludes.

Political reservations are not the only kind of apprehension that enters the picture. In a study of 28 computerized grass-roots groups, University of Wisconsin researcher Timothy Haight found that while on the

Photograph by John Woolliscroft

whole the groups had few problems using computers, there were exceptions. Computers for Christ, which serves fundamentalist church congregations, is one. "Several of the ministries were concerned that computers were a manifestation of the Beast of the Apocalypse," Haight reported.

APPLES VS. CHAIN SAWS

If there is such a presence, it's probably being felt by U.S. Bureau of Land Management (BLM) officials in southern Oregon, where a stubborn band of computer-wielding home owners has shown that the personal computer is a match for the chain saw. As of October of last year, the group had forced the BLM to cancel a routine timber sale. Since then they've entangled more sales in a web of protests and appeals that could end up changing forestry practices throughout the country. What's happening in Oregon is a textbook case of what a small band of seemingly powerless citizens can do with a little help from their friends. . . and a computer or two.

Richard Bach's best-selling book of yesteryear, *Jonathan Livingston Seagull,* is a story about a sea gull who does impossible things because he believes he can. It may sound corny to make the analogy, but that's pretty much what happened when a group of rural neighbors came together over the Bachs' computer and took on the U.S. Bureau of Land Management.

The tale actually began a couple of years ago when Richard and his wife Leslie left Los Angeles and moved to the idyllic Little Applegate Valley in the southwestern corner of Oregon. "We looked all over the country for a couple of years and finally found the spot," Bach says, adding that it's something "right out of a travel guide to Shangri-la."

They bought a 20-acre parcel on a hilltop with a panoramic view across the 15 miles to California, built a little house there, and then listened in dismay as neighbor Diane Albrechtsen dropped a bombshell: "They're going to cut all the trees down and they won't grow back."

The Bachs were disappointed but philosophical. They said, "Well, it looks like we moved to the wrong place and now let's move on. We'll find some other place, farther north, farther away. But before we do that let's just double-check to make sure that it's a legal timber sale." The Bachs didn't realize it at the time, but they were about to embark on an endeavor that would consume the next two years of their lives.

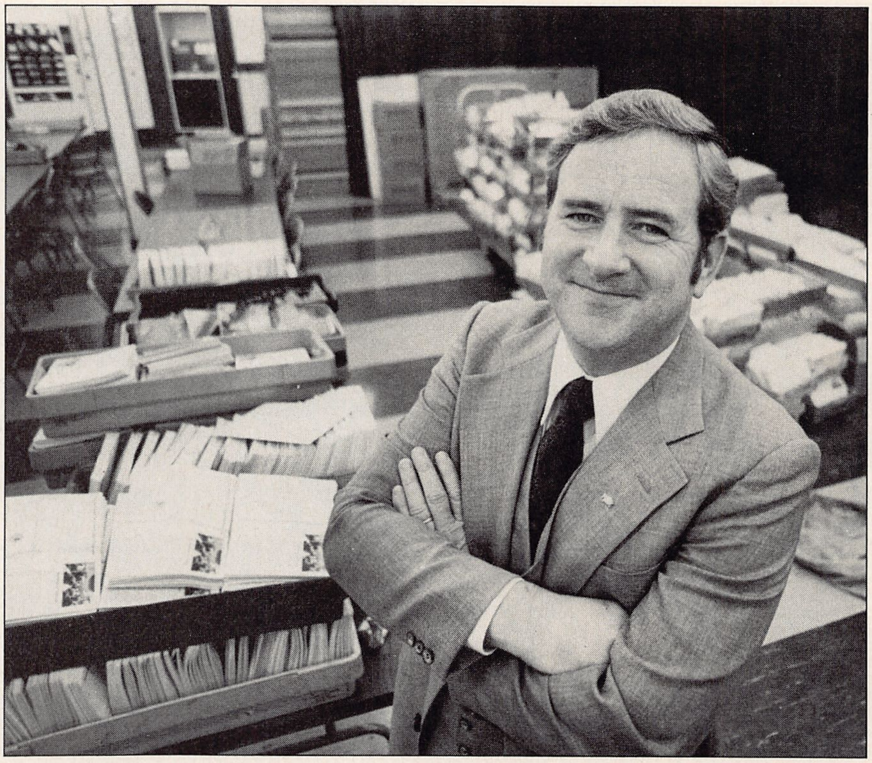
What they immediately learned was that much of the area was public land under the control of the BLM and that by law the BLM is required to identify commercial stands of timber and periodically offer these tracts for sale. Mrs. Albrechtsen and other Little Applegate Valley residents had unsuccessfully tried to stop earlier timber sales, including that of a 40-acre stand in Grouse Creek Canyon, directly across from the Bachs' property. Trees had been cut years before in the same area and had never grown back.

But as the concerned residents delved into stacks of arcane forestry laws and regulations, transcripts of congressional hearings, and BLM records, discrepancies between law and practice took on palpable form. "As we gained an education we saw that what was happening was the old method of timber management called cut-and-run," Bach says.

Although Bach had never before been involved in any kind of social protest, his wife had. After 20 years as a movie and TV actress, Leslie had turned to political organizing in the entertainment industry and pursued it far enough, her husband says, to get "clubbed and teargassed in the streets" during a demonstration against the war in Vietnam.

Leslie immediately drew on her organizing skills.

Activists of all stripes, including Jerry Falwell of the Moral Majority, are recognizing the power that the microcomputer can give them.



Photograph by Dennis Brack/Black Star

She helped to create an umbrella organization called Threatened and Endangered: Little Applegate Valley (TELAV) that spontaneously attracted 700 members. TELAV quickly raised the ante, protesting the entire 400 acres of the Grouse Creek timber sale, and the Bachs prepared for a fight. Their principal weapons were a growing sense of indignation and a pair of Apple II computers they had bought soon after moving to Oregon for writing and record keeping.

TELAV and the Bachs used the computers as terminals to gather information from public data banks and as word processors to help organize and analyze the mounds of raw information and, later, to prepare the documents appealing the BLM's planned sales.

For example, by dialing up The Source, a commercial database service available over the telephone to members with microcomputers or terminals, they were able to search records of previous timber-sale protests and their outcomes. "We got back something like 82 different precedents of people who had been outraged at what they saw going on and tried to protest—and were almost invariably shot down," Richard says. The common denominator among these failed appeals, Bach says, was their reliance on humanitarian or emotional arguments rather than hard proof of specific errors on the part of the government (most of these cases involved the U.S. Forest Service because the BLM manages little timber, but the principles were the same). In the absence of "clear error" by the BLM or the Forest Service, the Interior Board of Land Appeals, the court of last resort in an appeal case, invariably let the sales continue.

Following the initial research, the Bachs and TELAV typed into their machines all of the laws that were relevant and important enough to be challenged, and then they typed in alongside these the records of what had actually been done, thus highlighting the discrepancies on which their arguments for appeal were based. In this way they detailed 19 major violations involved in the proposed sale, with 12 of these concerning federal laws. ("We didn't even bother with the minor ones," Leslie says.) As they worked the paper mounted—eventually filling two file boxes and overflowing into a stack four feet high; the computer data itself filled a shoebox with floppy disks. Bach says the Apples never cooled off.

Although the arguments were wide ranging, the basic contention was that the BLM violated its own rules on numerous occasions by allowing timber cuts in areas where trees will not grow back. By definition, land qualifies as "commercial" timberland when trees can be regenerated within a certain number of years. Current regulations say five years, but the BLM is trying to change that to 15 years. The exact figure doesn't really matter, say the Bachs, because some areas they

CONTINUED ON PAGE 156

Circle 69 on inquiry card ➡

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Osborne Retools for Modern Times

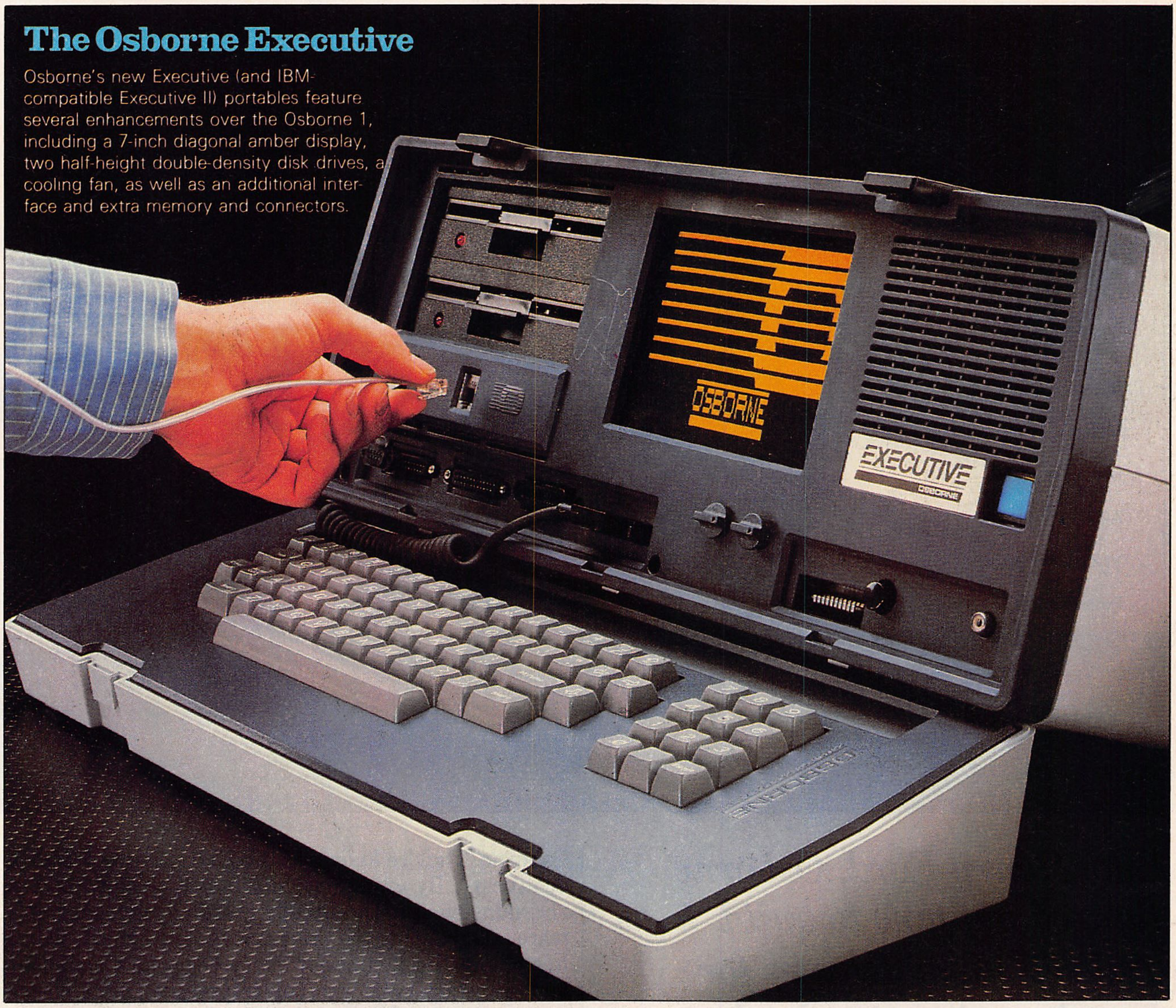
"Adequacy is sufficient; all else is irrelevant."
—Adam Osborne, Chairman
Osborne Computer Corp.

By cramming in a bunch of new goodies, keeping prices close to the bone, and tossing in optional IBM-compatibility, Osborne has come up with an impressive price/performance combination.

by A. Richard Immel

It was barely three years ago that industry gadfly Adam Osborne, the brash young Englishman with the big ideas and barbed tongue, put his money where his mouth is and started his own computer company. He did it to plug what he saw as a gaping hole in the market: the need for a personal computer that offered everything a businessperson required—all of the programs, all of the hardware—wrapped together in a single box you could carry like a briefcase and stash under your airplane seat. And he offered it at a price that would excite the mass market: $1795.

Critics giggled at the squinty, 5-inch monitor. They chuckled at the skimpy disk format that could barely store a Christmas card list. And they roared at the size, which stretched the definition of "portable" to the limits of the language. At a chunky 24½ pounds,



The Osborne Executive

Osborne's new Executive (and IBM-compatible Executive II) portables feature several enhancements over the Osborne 1, including a 7-inch diagonal amber display, two half-height double-density disk drives, a cooling fan, as well as an additional interface and extra memory and connectors.

the Osborne 1 had the heft and bulk of a home sewing machine. Some started calling it a "transportable" computer and others asked, "Who really wants to stow a computer under an airplane seat, anyway?"

Last year Osborne Computer Corporation revenues hit $70 million, and by the time you read this the company will have produced more than 100,000 Osborne 1 computers—enough to make Osborne the fourth largest maker of business-oriented micros in the U.S. (behind Apple, IBM, and Tandy/Radio Shack).

Predictably, Osborne's success has opened the floodgates to all manner of portable and transportable personal computers. These range from the pricey, $9000 Grid Compass with its electro-luminescent flat screen and bubble memory on through a bevy of Osborne look-alikes down to a couple of $200 Japanese models equipped with miniature keyboards and liquid-crystal displays.

All in all, that variety is enough to make some people wonder if Osborne may at last have been out-Osborned by the competition. Indeed, Osborne has been hammered on one side by an aging but surprisingly resilient Apple II and now by its latest incarnation the Apple IIe. On the other side it was blasted by a new generation of transportables that do what the Osborne 1 does and, more ominously, feature compatibility with the newer guy on the block, the IBM PC (Personal Computer).

The New Osbornes

But now come the Osborne 1's long-awaited successors. And although at first glance they don't look any different from the Osborne 1, there are some big surprises inside. Right at the top, they're not called

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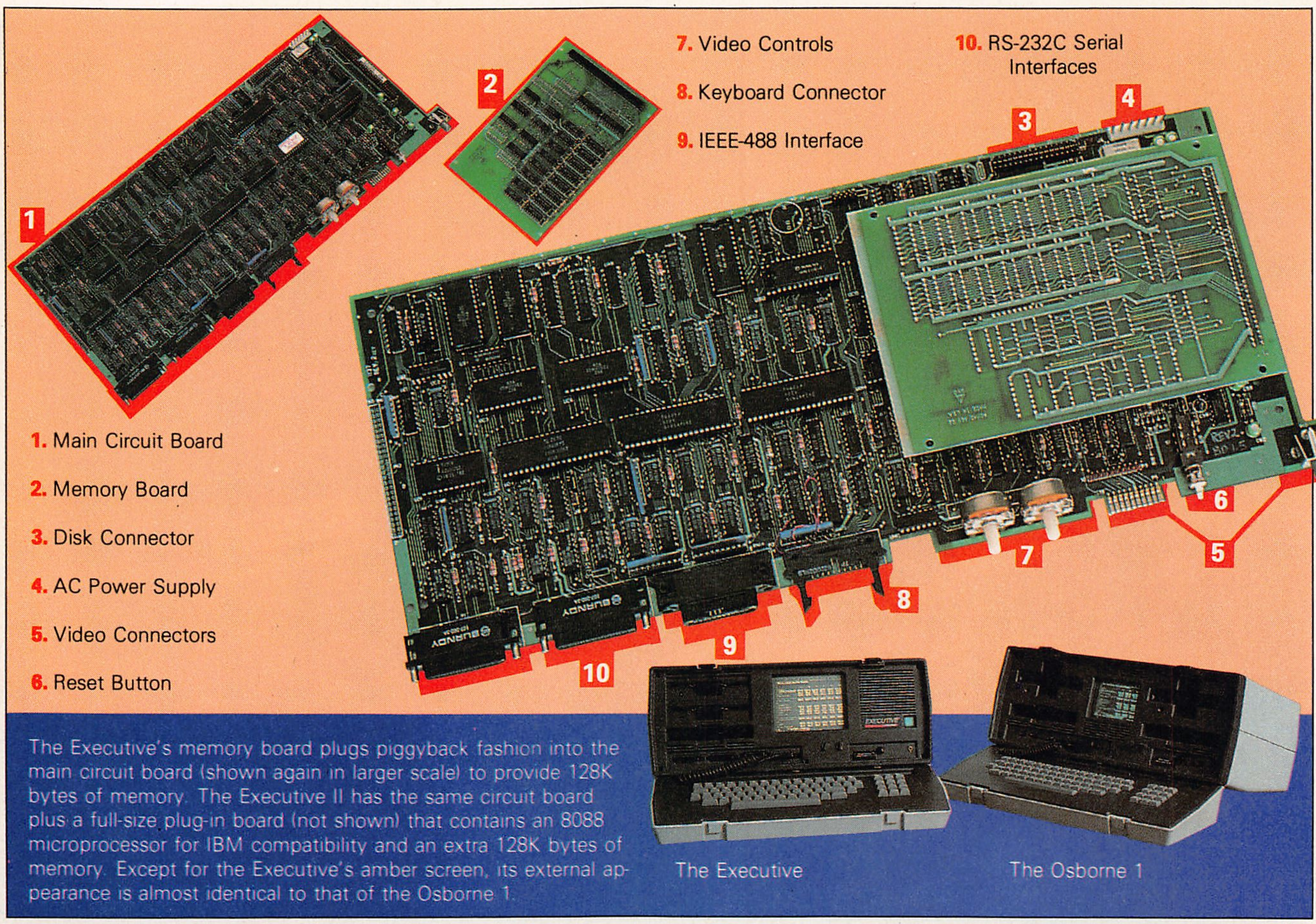
A. Richard Immel is a contributing editor of *Popular Computing.*


1
2
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4
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6
7
8
9
10
7. Video Controls
8. Keyboard Connector
9. IEEE-488 Interface
10. RS-232C Serial Interfaces
1. Main Circuit Board
2. Memory Board
3. Disk Connector
4. AC Power Supply
5. Video Connectors
6. Reset Button

The Executive's memory board plugs piggyback fashion into the main circuit board (shown again in larger scale) to provide 128K bytes of memory. The Executive II has the same circuit board plus a full-size plug-in board (not shown) that contains an 8088 microprocessor for IBM compatibility and an extra 128K bytes of memory. Except for the Executive's amber screen, its external appearance is almost identical to that of the Osborne 1.

The Executive

The Osborne 1

Like Henry Ford, Osborne figured out how to build and sell his machines for less: by using standard parts and by keeping them simple.

Osborne. They're known as the Executive and the Executive II. By cramming in a bunch of new goodies, shrinking some of the circuitry, adding even more software, and keeping the price close to the bone, Osborne has eliminated just about every Osborne 1 complaint and come up with another impressive price/performance combination.

Beyond that, however, the Executives represent two significant departures for the company that started the low-cost portable/transportable movement: emphasis on a software-reconfigurable computer and a leap aboard the IBM-PC-compatible bandwagon.

The new machines (as is the Osborne 1) are based on the ubiquitous industry workhorse, the 8-bit Z80A microprocessor, but that's just a starting point. They both, for example, include these new features:

- a larger, easier-to-read, 7-inch diagonal amber screen (2 inches larger than Osborne 1's white-on-black or green-on-black screen) displays 24 lines of 80 characters
- 128K bytes of bank-switched random-access memory (RAM), twice the old capacity, and the new CP/M Plus operating system to make the most of the extra memory

Photographs by Michael Jay

- a software-configured keyboard and a changeable character set, which make it a snap to adapt the machine to foreign languages
- easy access to mainframe computer communications via a built-in synchronous serial port
- terminal-emulator software that allows the Executive to mimic a variety of industry standard terminals; this makes possible communication with most online databases
- Personal Pearl, a simplified database program. This is in addition to the software that comes with the Osborne 1: Wordstar, Mailmerge, Supercalc, CBASIC and MBASIC.

The upscale Executive II is likely to arouse more interest than the Executive. Designed for the IBM crowd, this version has everything the Executive has, plus:

- a second processor (Intel 8088, as in the IBM Personal Computer) that allows the machine to run most of the software available for the IBM PC, including IBM video graphics, which run as shades of amber on the monochromatic Executive II
- an additional 128K bytes of RAM dedicated to the 8088 coprocessor and empty sockets to hold another 128K bytes of RAM, all of which adds up to a total of 384K bytes of onboard memory
- two additional IBM-compatible operating systems: MS-DOS and CP/M-86

Both machines also have enhanced video display characteristics. Besides the underline and dim features of the Osborne 1, the Executives provide reverse video (dark characters on a light background), blinking, and an extra user-programmable 128-character set. The Executives also are equipped with a pair of half-height single-sided double-density disk drives that hold 200,000 bytes of data each (the same as on the Osborne 1 upgrade) and can automatically read any of seven disk formats.

Osborne engineers have added a fan to cool down all this hot stuff, a thermo-coupled unit that turns only as fast as necessary to keep the internal temperature within the computer's operating range.

What's the tab for all of this? The standard Executive goes for $2495; list price for the top-of-the-line Executive II (as of press time) is $3195. Incidentally, Osborne's approach to announcing the new machines is a little different from most companies this time around. The company intends to stock retailer shelves with 20,000 units *before* the official release date. Also by that time, the Osborne 1 as we know it today may well become a collector's item as the production lines for that unit will have long since ground to a halt. The Osborne 1's successor, a smaller, lighter, and less expensive version of the same machine, should be available this year.

The King Is Back, Or Is He?

The question for Osborne now boils down to one of position: Is the company still playing catch-up, or has it gone ahead of the pack? Adam Osborne himself has no doubt his company is back in the saddle and has jumped out in front. "I think with the Executives we've jumped ahead," he says. "If you look at the competition—I'm now talking about competition in terms of machines that are actually being built; anyone can *announce* anything—I think we're ahead of them in terms of value for money. We're offering all the previous software along with a database. We've got good graphics now and a programmable character set, we have the extra synchronous serial I/O port, we have a 128K-byte RAM, and we have the IBM-compatible option."

How important is IBM compatibility? Osborne thinks it's vital for his company's survival. "IBM has been very clever about the way it has introduced its product to the market and there are so many of them around now. IBM has also made it very easy for new machines to be IBM compatible. The company virtually encourages it. The result is everybody is there and everyone is voting for it with their dollars. You might as well join the bandwagon, really.

"Corporate America has now blessed the microcomputer because IBM did; now Corporate America is going in droves toward IBM as a standard. So if you want to tap that market you've *got* to go in there with something that's IBM compatible. It's that simple."

It's not that simple, of course. There are some computer makers of substantial size—Apple and Tandy among them—who have shown no inclination to throw in the towel in favor of an IBM "standard." However, for companies that are still trying to carve out market share, Osborne's observation may indeed be relevant.

Actually the decision to go to IBM compatibility by putting in a second microprocessor came relatively late in the project. "Frankly, the coprocessor is something we decided we'd have to include after the system was well into the design phase," says product manager Tom Hayes. System design began in April 1982 but the design team wasn't committed to compatibility until November. "At that point it became clear we'd have to deal with the IBM PC," Hayes says.

However, one thing Osborne didn't deal with is size and weight. The Executives weigh in at 28 pounds which is 1½ pounds more than their predecessor (the Osborne 1 gained weight last fall when it was given a new case) and about the same as competitors such as Kaypro or the IBM-compatible Compaq. "We're looking for ways to remove some of the weight," Hayes says, "but there's not much we can do. It's still possible to carry it out to your car, although I wouldn't want to carry it across town. But I wouldn't want to do that with the Osborne 1, either."

Osborne also decided to stick with the exact same

I'm no pioneer, says Osborne. I'll just go with whatever is popularly acceptable and let the marketplace be the judge.

case as the older unit. The decision was an easy one. "It saved us one-third of a million dollars in tooling costs; need I say more?" Hayes explains. "Besides, we wanted to maintain the look of the Osborne 1. (Indeed, the folks at Osborne seem to have quite a thing about the Osborne logo. They're so enamored of the design—blue stripes on a gray background—they've painted the entire exterior of the company's new, multistory headquarters building in Hayward, California, in blue and gray, turning the building into an enormous Osborne logo. It's very distinctive, even in California.)

Obvious Differences

Superficially, the feature that most distinguishes the Executives from the Osborne 1 is the new video screen, a brilliant, 7-inch (diagonal) amber display that has crisp definition, is very easy on the eyes, and virtually eliminates the need for an external monitor. (Technically, it's not amber phosphor but a high-speed yellow phosphor cathode-ray tube with an amber filter. The reason for choosing yellow phosphor is longevity; instead of a life span of 2000 hours for amber, the yellow monitor will last 8000 to 10,000 hours, engineers say.)

Also, a beefed-up power supply has done away with the annoying "ripple" that occurs on screen when the disk drives are turned on. The user can also flip a switch to accommodate European voltages.

Another obvious difference is a pair of half-height disk drives that nestle snugly on the top left side of the front panel. All of the various plug connectors are still located across the bottom of the front panel, which means that connector cords will still get in your way. "Like working with an octopus" is the way one secretary describes the experience.

There are some minor differences even here, though. On the far right side on the front panel is an RCA-type jack that carries a composite video signal so you can directly plug in an external monitor (the old connector that provides separate video and synchronous signals is still there in case you have an old Osborne monitor you want to use, or need the separate signals for some kind of custom video arrangement). On the left side there are now two connectors for external serial communications: the old standard asynchronous RS-232C serial port to connect with a printer, and another RS-232C port that carries synchronous signals to allow the machine to communicate with a mainframe computer.

Most of the excitement is over what's inside the box, however. The Executive has 128K bytes of bank-switched memory, twice the maximum memory capacity of a typical 8-bit personal computer. Its more intelligent brother, the Executive II, is crammed with another 128K bytes with room for an additional 128K if you're so inclined. Signals are available on the board to address another six banks of memory, although Osborne has no plans to implement such an expansion.

The 8088 coprocessor and its dedicated memory are mounted on a full-size circuit board that's fastened piggyback style to the main board. When running IBM programs the Z80A microprocessor becomes a slave to the 8088, functioning as an intelligent I/O controller to handle various input and output needs.

How Compatible with IBM?

Given the fact that legally nobody can directly copy IBM's ROM (read-only memory), which is the origin of certain routines carried out within the machine, the most any competitor can claim is partial compatibility. It is possible, however, for a programmer to write programs that use certain unique features of the ROM or to bypass either of the standard operating systems—MS-DOS and CP/M-86—and write software that depends on unique features of the machine's architecture. An example of this is Visi On, the mouse-controlled window-display program package that will compete with Apple's new Lisa business computer and is under development by Visicorp for the IBM PC.

On the other hand this approach to software compatibility is relatively unusual. Jim Schwabe, product manager for the Executive II, feels that his machine has achieved a level of compatibility that will allow most IBM software to run directly disk-for-disk in the new Osborne. "We expect 95 percent of the software available for the IBM will run on our machine," he says.

One thing the Executive II lacks is a way to plug in IBM add-on circuit boards. What the machine does have is a pin connector on the edge of one of its circuit boards to provide all the signals IBM provides for its plug-in cards. These signals could be routed to some sort of expansion box into which IBM cards could be inserted. Osborne isn't offering such an expansion box, although it does expect third-party companies to make something like this available as an add-on peripheral.

The Sophisticated Executive

If you don't want or need to run IBM programs, the simpler version, the Executive, is an interesting machine in its own right. Even though the machine uses 64K-bit memory chips rather than the 16K-bit chips of the Osborne 1 and although a number of other circuits have been shrunk through the magic of VLSI (very-large-scale integration) the total chip count is actually higher by about 20 percent because of features added to give the machine more sophistication.

An example of this sophistication is the bank-switching feature that sets aside half of the 128K-byte memory for the operating system and several other utility operations such as enhanced disk access. Half of this 64K-byte bank is reserved as a buffer so that when a program calls for data to be read from one of the disks, that data is retained in the buffer. If the program later requires the same part of the disk to be read, instead of physically reading it again from disk, the program takes the data from the buffer memory, an enormously speedier operation.

Part of the remaining 32K-byte memory bank is used for a disk-drive routine that recognizes other manufacturers' disk formats. The Executives are unique, Tom Hayes says, in that they accommodate these different formats automatically without requiring the user to do anything or even be aware that another format is being read by the disk drive. Disk formats supported by this feature are Osborne single- and double-density disks, IBM PC, DEC VT180, Xerox 821, Cromemco mini-disk, and UCSD p-System Universal Format.

This bank also contains keyboard translation tables. Both versions of the Executive come with completely "soft" keyboard configuration, which means the definition of each key is loaded in alterable software rather than contained in an unchangeable ROM chip, as is the case with most computers. Osborne provides a utility program that makes it easy for you to change

At a Glance

Name: Executive, Executive II

Manufacturer
Osborne Computer Corporation
26538 Danti Court
Hayward, CA 94545
(415) 887-8080

Uses
Business and home computing

Standard Features (both models)
8-bit Z80A microprocessor; 128K bytes of RAM; 69-key detachable keyboard including 12-key numeric pad; integral 7-inch amber display monitor with 24 lines of 80 characters, reverse video, blink, dim, underscore, programmable character font, two 128-character sets; two half-height single-sided double-density disk drives, disk formats for Osborne single- and double-density disks, IBM PC, DEC VT180, Xerox 821 single density, Cromemco mini-disk and UCSD p-System floppy disks; software included: Wordstar, Mailmerge, Supercalc, CBASIC, MBASIC, Personal Pearl; CP/M Plus and UCSD p-System operating systems; terminal emulation utility; RS-232C and IEEE-488 interfaces; external monitor and composite video connector; self-contained plastic carrying case

Standard Features (Executive II only)
Intel 8088 microprocessor; additional 128K bytes of RAM; sockets for another 128K bytes; MS-DOS and CP/M-86 operating systems

Base List Price
$2495 for the Executive
$3195 for the Executive II

Size
20.5 by 13 by 9 inches; 28 pounds

Documentation
General reference guide in 3-ring binder; primer/tutorial, guide to CP/M plus and Pascal p-System, guide to applications software, and guide to Personal Pearl, all in perfect-bound softcover books

the definition of any character on the keyboard, at will. Another program lets you alter the shape of the characters or create new ones. These features were incorporated at the insistence of the International Marketing division to make the machines more suitable for foreign markets.

Osborne has no plans at present to offer buyers of the Executive any means of upgrading to an Executive II. "Our feeling is that since we're going to offer both at the same time, a buyer can decide which one he wants," Hayes explains. However that doesn't rule out a change of heart if enough demand for upgrade kits or retrofits develops at some later date.

Future Osbornes

Down the road, Osborne engineers are looking at several ways to improve the two Executives. A new, step-sculptured keyboard with a better "feel" is on the way as soon as stocks of present keyboards are exhausted. Beyond that, Hayes says, engineers are looking for ways to increase data storage capacity. "We're evaluating higher disk storage," he says, of up to 800K bytes per disk. A problem with the drives tested so far has been lack of dependability. "With a portable you need a level of ruggedness that goes beyond what's available," he says. "We're becoming very quality conscious."

Osborne is also looking at Winchester-type hard disks with an eye to replacing one of the floppy-disk drives with a removable cartridge hard-disk drive. However, the harsh conditions under which Osborne computers operate raise some serious environmental concerns "over incredibly simple things like condensation," Hayes says. "Winchesters have breathing holes, which suggests that condensation could form inside. It doesn't take a big drip of water to cause a head crash."

How long are the Executives likely to remain competitive? Even Adam Osborne doesn't have an opinion on that. "Who would have believed that the Apple II would still be selling today," he says. "On this whole thing about adequacy being sufficient, the reason the Osborne 1 was going to run into trouble was because the screen was too small. I still think a 9-inch monitor is a mistake for a portable because it locks you into something that is too big and heavy to be portable. But, if we'd been able to get a 7-inch monitor cheap we'd probably have had another three or four years of life out of the Osborne 1 because it does everything else you might want to do."

As for the next breakthrough, a truly portable computer at a reasonable price, that's still several years away, he says. "You can't have a real battery-operated computer with a lot of life in it if you've got a monitor and disk drives. Machines like that draw too much power. But if you can get a liquid-crystal display and CMOS logic [a type of circuit that retains its data with power from a battery] or something like that, then sure, you can do it." But, he adds, "You're talking about 1985, 1986" for this technology at a mass market price.

True to his "adequacy" philosophy, Osborne isn't impressed with Apple's Lisa business machine and its emphasis on a mouse pointer and windows. "It's kind of odd to think that the business managers of America's companies are so thumb-handed that they can't use a keyboard, that they need a mouse to simplify things. It just doesn't make any sense to me. To me it's just a plain gimmick."

No Software Before Its Time

The mouse may be a gimmick to Adam Osborne, but Osborne the company isn't ruling it out. Osborne officials have been talking to Visicorp about the possibility of incorporating Visicorp's mouse-actuated window system, Visi On, into the Executive II.

The idea of using popular, off-the-shelf software and bundling it in the price of the machine has been a bedrock philosophy of Osborne's approach to useful but low-cost business computing. Osborne's unwritten company directive "Thou shalt not author software" isn't likely to change much in the near future.

"No normal, sane person would want to be in the software business," asserts product manager Hayes. "It's a zoo." He says an organization the size of Osborne simply doesn't have the time or resources to develop applications software and operating systems. "By being able to go out and buy things off the shelf we avoid development costs and we also can pick and choose from packages that will do the job."

As for operating systems, "We're not in a position to dictate standards to the industry so we handle as many as we can. I can spend hours telling you how terrible CP/M is but if you're talking about a mass market it's the only standard there is," Hayes says.

Even the recent trend toward integrated packages (that is, a single program that combines a number of applications such as a word processor, spreadsheet, and database in a coordinated framework that uses the same commands) is no temptation for in-house software development. "There's going to be enough of it coming out in the CP/M-IBM world," says Osborne. "We'll just buy it. No need for us to develop our own." Osborne says he's not locked in to the software he now offers but is "comfortable" with it. "Other people like the software so we keep selling it. I'm no pioneer. I'll just go with whatever is popularly acceptable and let the marketplace be the judge."

So far that judgment has tipped in Osborne's favor. It seems likely the two new entries will shore up a market that was showing signs of running out of steam. Because of impending plans for an initial public offering of Osborne Corporation stock, Osborne officials, including Adam, were reluctant to talk about market projections (something about hyping the stock, they said, an activity frowned on by the Securities and

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Exchange Commission). Nevertheless, sales director Fred Brown said he expects the company's first three months of production for the two new machines—over 15,000 units—to be sold out by the time they are announced. Brown says that early buyers will be several of the big accounting firms, the government's General Accounting Office, and corporations such as Borg-Warner.

A Marketing Shift

An important new marketing strategy for Osborne in its battle to wedge into large-volume corporate sales is its agreement with Harris Computer Corporation under which Harris will offer third-party sales and services to large corporate customers. Harris, a $1.7-billion, Florida-based minicomputer and satellite communications concern, will concentrate on volume buyers—those who buy a minimum of 50 units at a crack.

Osborne presently markets through retail computer stores such as Computerland and office equipment dealers. Brown is betting that the emphasis by Harris on volume sales along with the relative obscurity of the company to retail computer dealers won't upset Osborne's existing retail relationships. "I think everybody [every manufacturer] is going to have to do this," Brown says. "You can't go into a corporation with a retail mentality; you can't have a 19-year-old kid with braces in a retail store talking X.25 standard communications protocols."

Osborne is banking heavily on the enhanced communications abilities of its Executive models, their ability to talk to mainframe computers and emulate other terminals. Brown sees as his main target the middle manager "who wants to use it as a communications station and access his company's database, and then at the end of the day be able to pack it up and take it home to do a little more work at night."

Another increasingly important market is overseas sales. Osborne has specifically targeted this market by making the new machines easily adaptable to foreign languages and power supplies. Presently, international sales account for about 25 percent of total revenues, but Adam Osborne sees it climbing realistically to 40 percent. He says the Osborne 1 is number three in sales in Australia and the United Kingdom and recently pulled abreast of Apple in South Africa as the result of an aggressive, experimental marketing campaign.

Is Adequacy Sufficient?

So what's the bottom line on all this? The two Executives aren't state of the art, but then Adam Osborne never promised state of the art. They certainly are significant improvements on an Osborne 1 that was becoming increasingly inadequate in the market the company is going after. The Executives are both solid products that ought to attract anyone who liked the idea of the Osborne 1 but was put off by its shortcomings.

If Osborne were a brand-new company, the new machines might not be enough. But it's not a new company; it's well established and has tried to develop a reputation for product dependability and customer support. The new machines should complement that nicely, both benefitting from it and contributing to it. These are machines that should help Osborne bridge into the next generation of truly portable computers.

In that sense, Osborne Computer is a company in transition. The upcoming stock issue is one sign of that and a shift in management that has taken place is another. Like most high-tech concerns that last long enough to do it, Osborne has moved from the infancy of start-up through the adolescence of a successful single product and now into the adulthood of multiple products and professional management.

Adam Osborne, the founder, remains chairman; he still has a comfortable office and drives a big Mercedes-Benz, but he's less and less in touch with the details of his product and the day-to-day operations of his company. In January, a professional was brought in for all of that: Robert Jaunich II, who took over as president and chief executive officer. Jaunich has roots in high-tech—he's a former Memorex Corporation executive—but his most recent conquest has been in the grocery business, running the Shasta soda pop subsidiary of giant Consolidated Foods. In fact, Jaunich left the presidency of Chicago-based Consolidated after only a month on the job when Osborne Computer made him an offer he couldn't refuse.

Even though his role in his own company may be changing, Adam Osborne remains a seminal figure in a very young microcomputer industry, a man who has brought fresh ideas into and opened up computing for many who wouldn't otherwise have gotten involved. Osborne says that he's no pioneer, but he is, in the same sense that Henry Ford was a pioneer. Ford didn't invent the automobile, but rather a better way to build autos inexpensively for the mass market. Neither did Osborne invent the personal computer, but he did figure out a way to build and sell computers for less than the competition. He did it like Henry Ford did: by using standard parts and by keeping things simple.

The introduction of these two new Executive models does mark a significant departure for the company, however. As Adam Osborne has oft stated, a cornerstone of his company's success has been the philosophy of offering a computer that requires no decision on the part of the buyer. Everything you need is there in a single, low-cost package. This freedom from decision-making is now gone. Potential buyers will have to agonize over choosing from among the Executive, the Executive II, and the Osborne 1 or its more portable successor.

Farewell, carefree days of yore. □

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SPECIAL REPORT

The Top 40 Low-Cost Printers

A guide to narrowing your choices and avoiding some big mistakes

by David B. Powell

It's a warm summer night. You're walking downtown when suddenly a stranger steps out of the misty lamplight and says, "Pssst. Buddy . . . wanna buy a printer?"

Of course, printers for personal computers haven't quite reached this level of availability, and most printer purchases aren't as reckless as street-corner deals. But printers are proliferating with incredible speed. And if buyers don't define their application needs in advance—and look for the features that best meet those needs—their transactions can be just as chancy, and the success as unlikely.

In this article we will help you define both your needs and the capabilities a printer must have to meet them. In the Buyer's Guide, which follows on page 114, we'll present a gallery of 40 of the most popular printers currently available for less than $1000, so you won't have to hit the streets to find the one that's right for you.

Impact Printing Technology

The most critical and confusing buying decision concerns which printer technology is right for your application. The reason for the confusion is that printers producing comparable output can use a wide range of techniques. Yet each technology has its advantages and disadvantages, and by narrowing your choices to a certain type, you'll find your decision much easier to make.

By far the most common technology is impact dot-matrix. This technique, which mechanically drives an inked ribbon against paper, builds characters and graphics from individual dots in a grid or matrix. Advantages of this extremely popular approach include

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David B. Powell is a freelance writer living in Brookline, Massachusetts.

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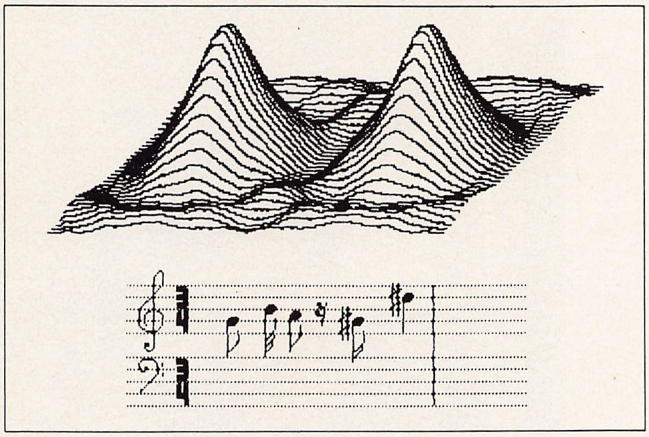
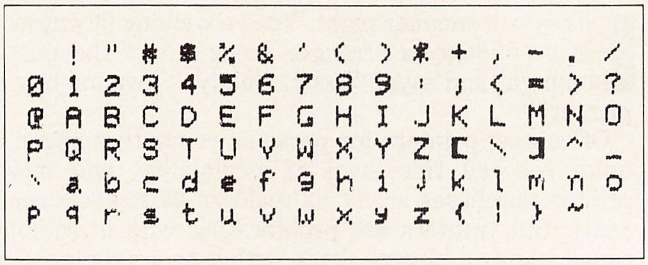


These days, low-cost printers can keep up with anyone's imagination. This sample was printed at 160 by 144 resolution on a Personal Micro Computers DMP-85.



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Which print quality is right for you? Low-cost printers now offer quite a range, represented by these examples. Shown above is a basic 5 by 7 character matrix, produced by the Axiom/Seikosha GP-100. The highest dot-matrix resolution available for less than $1000 is from the Mannesmann Tally MT 160, which uses a 40- by 18-dot character array (at right, top). The ultimate in print quality is fully formed letter-quality characters (at right, bottom), produced here by the Smith-Corona TP-1. As one climbs the quality ladder, one pays with declining print speed—from over 100 characters per second in many cases, to under 20 characters per second.

the ability of a single printer to produce both draft and near-letter-quality text, simply by changing dot-placement patterns. This makes impact dot-matrix printers ideal if you need a variety of output, including lower-quality program listings as well as somewhat more readable text and higher-quality correspondence. Anyone with such wide application needs should strongly consider the impact dot-matrix technology as a good all-around solution.

Also, impact dot-matrix technology can handle graphics output too. The machine simply prints dots in a back-and-forth, raster-like manner rather than in character matrices. Furthermore, if the print head can handle multicolored ribbons, the printer can produce graphics and text in full color, a capability not available with thermal or electrosensitive print-head technologies.

Another advantage is that impact dot-matrix—and any impact technology—can produce both originals and carbon copies. Most impact printers strike the paper with enough force to make three to five carbon copies, but the maximum number varies somewhat with printers. While not the most critical selling point for impact dot-matrix printers, the ability to produce carbon copies can be of immense value to those users—professional writers, for instance—who need to print several copies of a long manuscript or report in the shortest possible time. This capability can also reduce print-head wear because the manuscript must be printed only once, rather than several times.

Alas, dot-matrix printers have their disadvantages. If you need to print highly readable characters, the impact dot-matrix falls short. Better for such letter-quality text is a printer that hammers down complete, fully formed characters.

In the less-than-$1000 market, letter-quality printers use replaceable "daisy wheels" to produce text. (The name was coined because the print wheels look like daisies, with a raised character at the tip of each "petal.") To print a fully formed character, a solenoid mechanism strikes a petal, hammering it against the inked ribbon and paper.

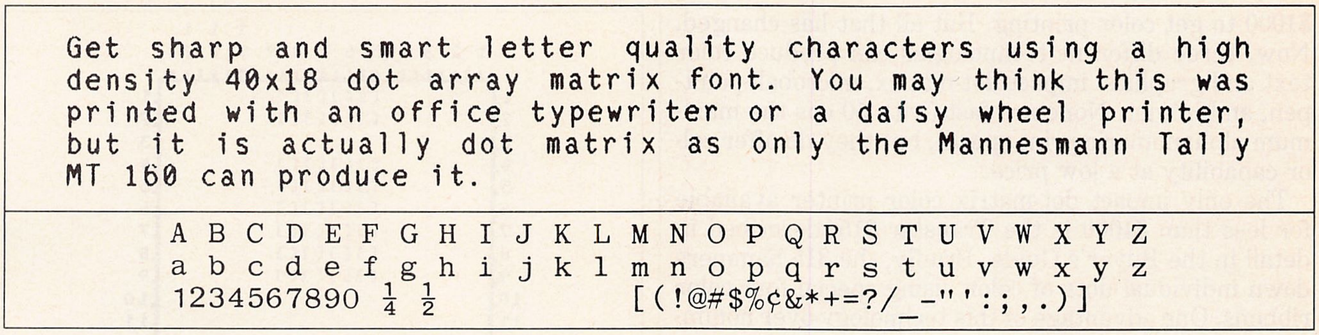
People who are looking for daisy-wheel printers that cost less than $1000 can still count their choices on one hand. One possibility mentioned in our Buyer's Guide is simply a typewriter with a computer interface attached. If you don't already own a typewriter, this option could be a cost-effective way to get the capabilities of both a typewriter and a daisy-wheel printer. If you decide that you want fully formed characters, the other options available for less than $1000 lack keyboards and offer only output capabilities.

To achieve high print quality you must sacrifice speed. Letter-quality printers that cost less than $1000 are among the slowest printers available, usually plodding along at 20 characters per second (cps). If you're planning to print large amounts of text, you will find this rate agonizingly slow. Also, if you want graphics output, you should look elsewhere.

Nonimpact Printing Technology

All nonimpact printing technologies—thermal, electrosensitive, ball-point pen, and ink-jet—share a couple of advantages over impact printers. First, nonimpact printers are generally quieter. Second, their print heads contain fewer moving parts, so they are usually more reliable mechanically.

Thermal and electrosensitive printers offer another potential advantage: accuracy in the placement of dots for graphics applications. Both technologies print characters by burning dots into special paper. Thermal print heads do so with wire electrodes and paper that darkens when heated. Electrosensitive print heads do so by vaporizing dots of a light, metallized coating, so that a dark paper base shows through. In both cases, it's possible to print a complete line of dots at once; this approach is widely used in such applications as scientific chart recorders, where the print head doesn't move. However, only a few nonimpact printers available for less than $1000 use fixed heads.



Get sharp and smart letter quality characters using a high density 40x18 dot array matrix font. You may think this was printed with an office typewriter or a daisy wheel printer, but it is actually dot matrix as only the Mannesmann Tally MT 160 can produce it.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
1234567890 ¼ ½ [(!@#$%¢&*+=?/_-"':;,.)]

The Buyer's Guide indicates those that do.

Although thermal and electrosensitive technologies could conceivably set the pace for print speed, they have yet to do so in the less-than-$1000 retail market. The fastest low-cost printer I know of is a special-purpose, electrosensitive machine for original equipment manufacturers from SCI Systems: the 1110 Rotary Printer, which sells for $980 and uses electrodes on a spinning drum to print 5 by 7 dot-matrix characters at 2200 cps (a rate equivalent to copying the contents of an entire 24-line by 80-column display in one second). What's more, this speed is positively poky compared with SCI's $1750 Model 1800, which can copy a screen's entire contents in one-third second. It's a paradox, then, that low-cost thermal and electrosensitive printers available for consumers still trail other technologies in print speed.

Both thermal and electrosensitive technologies have their drawbacks. Both types of printers require special papers, which some users find hard to read or unpleasant to touch. In addition, the cost per square inch can be higher for these papers than for plain bond. And thermal paper can fade if not properly stored.

Also, most thermal and electrosensitive printers now available to consumers accept only narrow paper in rolls less than 5 inches wide. Consequently, you'll find these printers most useful for producing narrow-strip graphics or program listings. However, with increasing support from manufacturers for 8½-inch-wide paper, the situation is changing. Wider paper is now particularly common in portable terminals for telecommunications applications. These terminals also capitalize on other benefits of nonimpact mechanisms, namely, their light weight and compact size.

Ball-point print heads use a turret that rotates four miniature ball-point pens (red, blue, green, and black) into writing position. The head controller and the paper-advance mechanism manage the horizontal motions of the print head and the vertical motions of the paper—much like a plotter—to print graphics or text in color or black on white. Ball-point printers are the main type used in hand-held computers. These printers are the only ones that can make true line drawings, but they are limited to using narrow paper.

Ink-jet printers spray dots of colored or black ink (or powder on the Irwin/Olivetti JP 101 printer) under the computer's control to form characters or graphics. Advantages include quiet operation and high reliability, thanks to a lack of moving parts.

Printing Graphics

Graphics may be the factor requiring the most careful consideration when you're choosing a printer. Although most printers that cost less than $1000 support some form of graphics, some print only graphics characters, that is, unusual dot arrangements within a character matrix. Such printers are fine if you don't need to print graphics a dot at a time, as in plotting.

Many printers in our Buyer's Guide boast dot-addressable graphics at varying resolutions. With dot-addressable graphics, you can individually control each wire in the print head and thus control where each individual dot is printed. This capability enables you to create your own character sets and print out detailed pictures. However, printers that offer dot-addressable graphics require a great deal of custom software, and not all of them are easy for nonprogrammers to use. A computer maven, comfortable with system programming, can implement graphics on any of these printers. Novices who want to plug in and plot, however, need to be more selective.

Before buying a printer, make sure the documentation is adequate for your needs and experience. With some printers, the documentation doesn't describe graphics programming on your particular computer, so you'd have to find the information elsewhere.

On the other hand, several printer manufacturers (you'll spot them in our guide) have recognized that some buyers cannot, or will not, become system programmers in order to print graphics. These manufacturers have come out with "software drivers" that let different computers make full use of a printer's graphics and text capabilities.

If graphics are important to your application, be sure to insist on a demonstration using a computer like your own before buying any printer.

Printing in Color

Until recently, buyers had to pay much more than

$1000 to get color printing. But all that has changed. Now, three different technologies can produce color text and graphics: impact dot-matrix, microball-point-pen, and ink-jet. None are fast (with 50 cps the maximum alphanumeric print speed), but they do offer color capability at a low price.

The only impact dot-matrix color printer available for less than $1000 is the Transtar 315, described in detail in the Buyer's Guide. Briefly, the 315 hammers down individual dots of color, using special four-color ribbons. One advantage of this technology over nonimpact (that is, ink-jet) color printers is that the impact dot-matrix can also print carbon copies (black and white), and the ink-jet can't. Thus if copies are important, decisions about a color-printing technique are relatively easy.

The majority of ball-point print heads use mechanisms from Alps Electric in Japan. Alps's ball-point mechanisms now handle just four colors. (It has been rumored that the company will release six- or eight-color versions, but that hasn't happened yet.) Because ball-point printers draw on roll paper narrower than 8 inches wide, they are ideal for some plotting applications but not for large volumes of text. Currently, most hand-held computers support only printers supplied by manufacturers.

Color ink-jet technology broke into the less-than-$1000 market last November with Canon's A-1210 printer. Prior to that, color ink-jet printers were simply too expensive for most consumers. Prices started at more than $3000 and extended to well over $10,000. But at $795, the A-1210 now opens the technology's capabilities to many buyers.

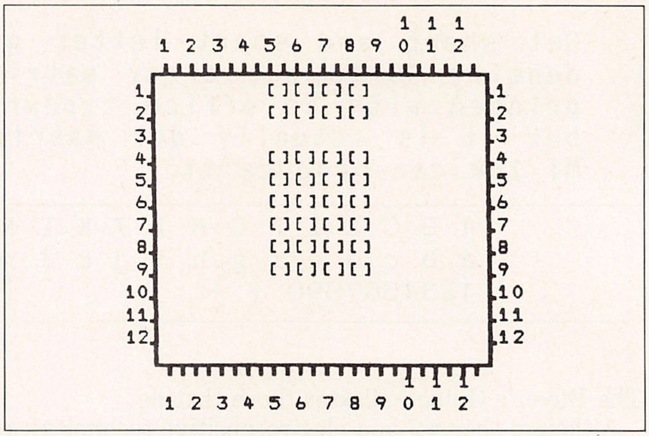
Ink-jet printers spray the ink in tiny dots, so they are often called "drop-on-demand" ink-jet printers. By overlapping color dots on the paper, such printers can produce many hues and tones from relatively few colors of ink. Canon's design (described in the Buyer's Guide) uses only four inks: three colors plus black. Because black ink is used up faster than the colored inks, Canon supplies it in a separate cartridge for easy replacement.

Basically, if you need to print high-resolution color images on paper wider than 8 inches, you now have only two choices for less than $1000: the Canon A-1210 and the Transtar 315.

Print Quality

Of course, the quality of printed text you need is critical to selecting the right printer. If you'll be using a printer only to produce program listings, then a small, quiet, inexpensive thermal or electrosensitive printer can fill the bill.

If you'll be printing many letters or other documents, printers that produce fully formed characters are probably best. These machines provide a variety of character sets, which you can easily change by switching daisy wheels. However, such printers are slow and operate best with cut-sheet paper.



Some low-cost printers let you design your own graphics characters or text fonts. For example, Micro Peripherals' Printmate 150 throws this design grid on a Zenith computer's screen. To create a character you simply choose which dot-matrix positions you want to fill. This capability illustrates an important trend. Manufacturers are realizing that many end users are buying printers as information appliances and simply want to plug in and go. Consequently, more manufacturers are beginning to offer interfacing software that lets individual computers make full use of a printer's features.

If you plan to produce great quantities of text, an impact dot-matrix printer with tractor feed for fanfold paper will probably save you time and the expense of buying a cut-sheet feeder. Impact dot-matrix printers offer a wide variety of text ranging from low to high quality at speeds needed for high-volume applications. These printers can create near-letter-quality characters simply by filling in more dots in the character's matrix. You should be prepared, however, for some speed loss during this printing method.

Both impact and nonimpact dot-matrix printers offer a capability not available with letter-quality machines—enhanced text. Depending on how the printer is programmed to move its print head, it can darken text with multiple overstrikes, compress more characters than normal into a line, expand character width, and increase character height. But these refinements can also slow a printer way down. The Buyers' Guide indicates printers that offer text enhancement.

You'll also notice in the guide that some printers include one or two capabilities that enable them to print at faster speeds: bidirectional printing, which enables the machine to print lines from right to left and from left to right; and logic seeking, where the machine looks at the next line to see whether it's faster to print the line forward or backward.

Character Sets

Another factor to consider is the content of your output, along with the character set the printer supports. If you need only program listings, an inexpensive printer that produces just uppercase letters will do.

However, most printers that cost less than $1000 offer a range of character sets that will probably meet

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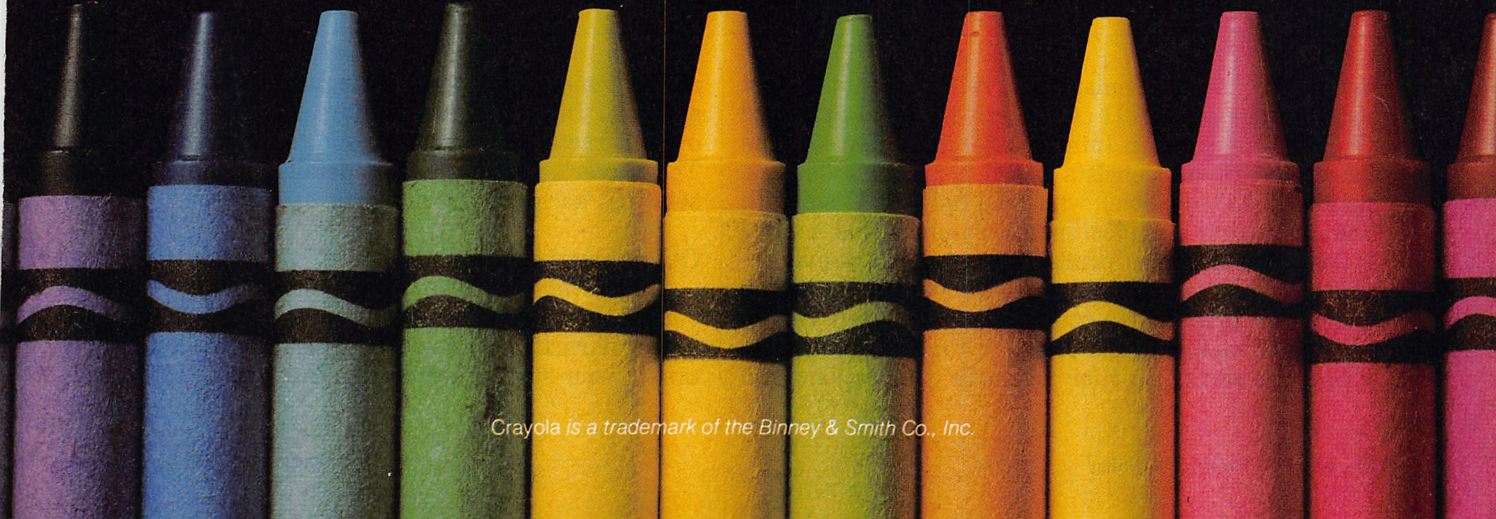

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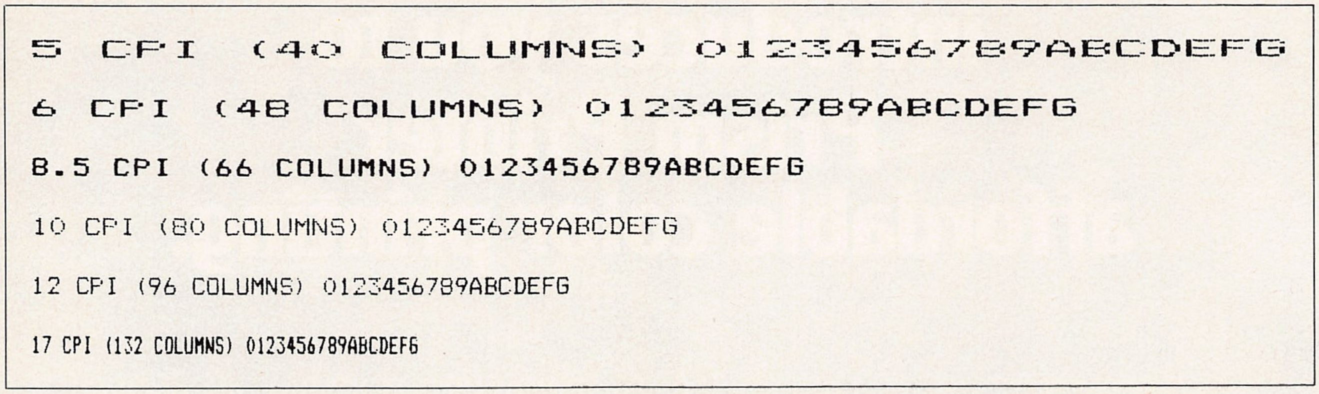


5 CPI (40 COLUMNS) 0123456789ABCDEFG

6 CPI (48 COLUMNS) 0123456789ABCDEFG

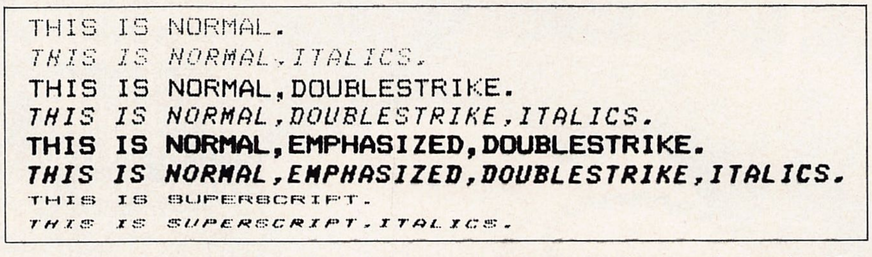
8.5 CPI (66 COLUMNS) 0123456789ABCDEFG

10 CPI (80 COLUMNS) 0123456789ABCDEFG

12 CPI (96 COLUMNS) 0123456789ABCDEFG

17 CPI (132 COLUMNS) 0123456789ABCDEFG

Both impact and nonimpact printers can expand or condense characters horizontally. When space is tight, many printers can cram quite a few characters into each inch. This Star Micronics sample (above) shows just one printer's density range—from 5 to 17 characters per inch. Some printers can also produce proportionally spaced text—like the kind you see in most magazines and newspapers—which allocates less space for narrow letters (like "i") than for wide letters ("w"). Most people find proportionally spaced text the easiest to read, so it is recommended for high-quality printing.

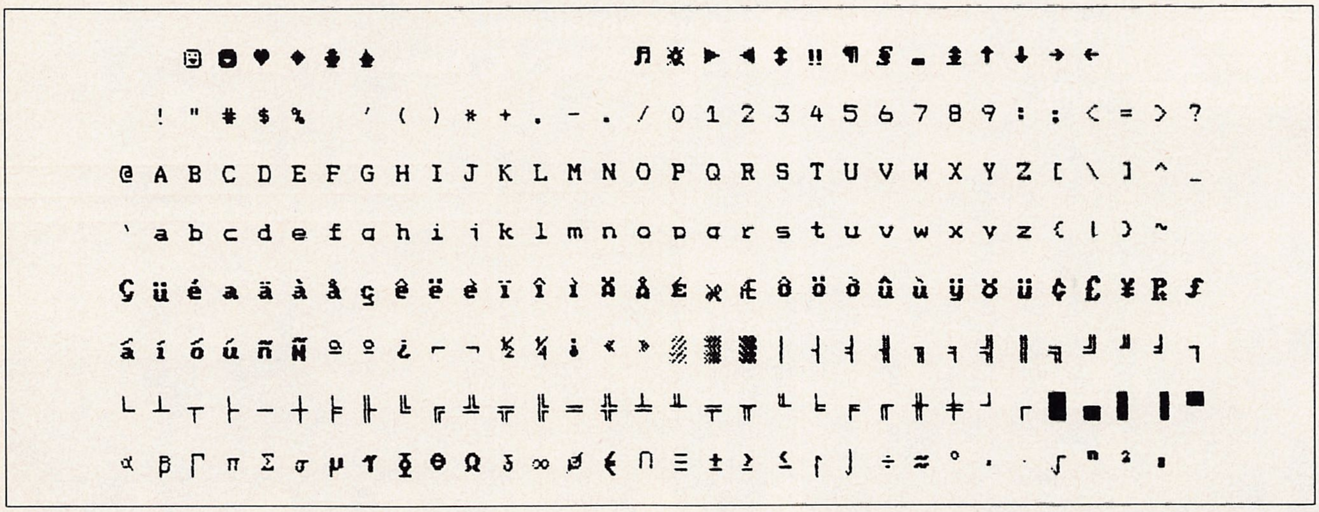


THIS IS NORMAL.
THIS IS NORMAL,ITALICS.
THIS IS NORMAL,DOUBLESTRIKE.
THIS IS NORMAL,DOUBLESTRIKE,ITALICS.
THIS IS NORMAL,EMPHASIZED,DOUBLESTRIKE.
THIS IS NORMAL,EMPHASIZED,DOUBLESTRIKE,ITALICS.
THIS IS SUPERSCRIPT.
THIS IS SUPERSCRIPT,ITALICS.

These samples (above) look so different that you might not realize they are all printed at 10 characters per inch. That's the beauty of italic or bold styles. They give you a chance to emphasize what you want to say. (Sample courtesy of Epson America)

When buying a printer, you should ask the manufacturers for comprehensive font samples before making your decision. The range of characters that less-than-$1000 printers produce is truly staggering.

For example, Micro Peripherals recently added the complete IBM Personal Computer graphics character set (shown below) to its large Printmate library.



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even the most demanding requirements. Most printers use an ASCII (American National Standard Code for Information Interchange) character set. The basic ASCII set consists of 96 characters (letters, numbers, and symbols), while the full ASCII set with 128 characters includes special symbols and control codes. In addition, a printer's character set may include graphics characters used in lower-resolution graphics applications, special symbols used by individual computers, the APL (A Programming Language) character set (for scientific applications and report generation), foreign-language fonts, and math symbols. In fact, some printers let you create your own characters to replace or add to the machine's set. The Buyer's Guide includes details on the character sets that each printer supports.

Other Considerations

A small hint is in order on consumables—the ribbons, paper, inks, and other supplies the printer uses during normal operation. These items add a continuing cost to your system's operation that you should antici-

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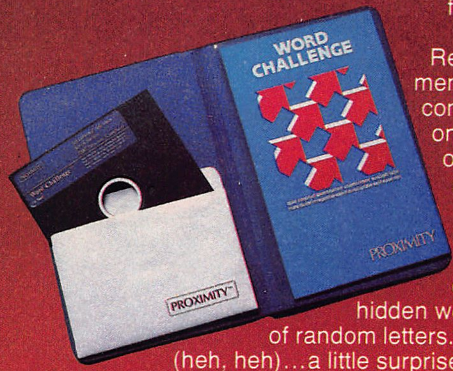
for Apple™, IBM™ and Osborne™ computers



Ready for some mental gymnastics, computer style? Take on Word Challenge,™ one of the most advanced, intelligent software game programs available. The object: locate the hidden words in a square of random letters. The competition: (heh, heh)…a little surprise from the programmers—LEX, an opponent of uncannily human intelligence. Word Challenge generates the game board (note the sample square, with 166 hidden words) and you race the clock with LEX to see who finds the most words. Naturally LEX knows that the longer the word, the better the points. So while you might enter "bar," "ant" and "den," LEX is picking out "abrase," "resented" and "serene," all part of his remarkable 90,000-word vocabulary. But don't give up hope. If LEX seems a little too formidable at first, you can give him a sort of electronic lobotomy by selecting from his 26 different playing levels. You can also choose the square size, time limit and a variety of scoring methods.

Word Challenge is a fast, entertaining and educational game that'll provide hours of fun for the whole family. It's great as a teaching tool for building vocabulary, spelling and problem-solving skills.

To master the Word Challenge, take a mere $39.95 to your nearest personal computer dealer. For Mastercard and Visa orders, call toll-free, **1-800-323-0023**. In Florida, call collect, 305/566-3511. Or complete the coupon and send your check or money order for $39.95 (plus $2.00 shipping and handling) to: Word Challenge, Proximity Software, 3511 N.E. 22nd Avenue, Fort Lauderdale, Florida 33308.

Please send ______ Word Challenge Disk(s) for which I've enclosed $39.95 each (plus $2.00 shipping and handling) Florida residents please add 5% sales tax.

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☐ Apple II, II Plus or II Plus E (min 48k) w/disk drive
☐ IBM Personal Computer (min 64k) w/disk drive
☐ Osborne I or II (min 64k) w/disk drive

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POPC 7/83

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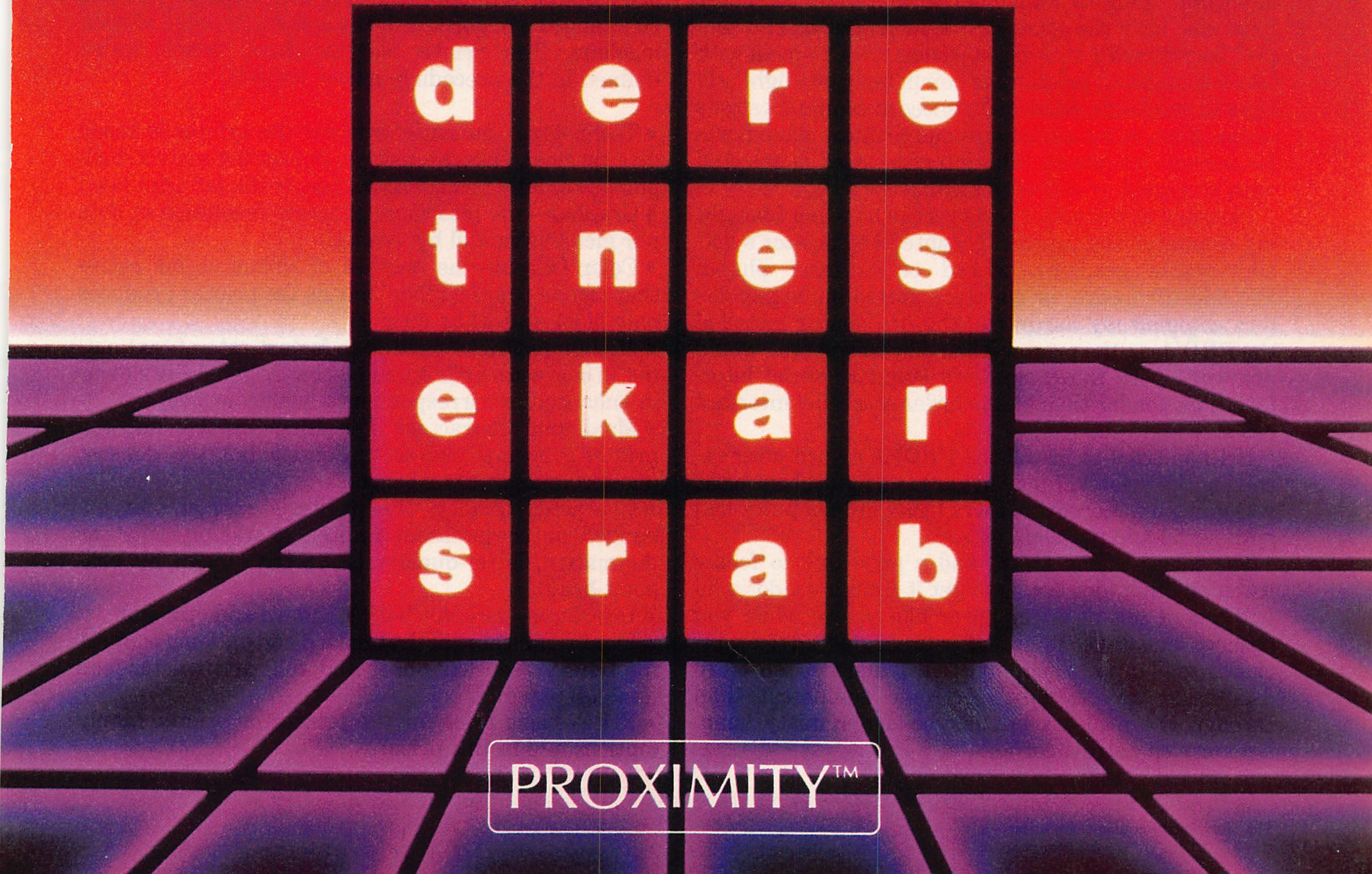


d	e	r	e
t	n	e	s
e	k	a	r
s	r	a	b

PROXIMITY™

pate and, to some extent, control. For example, some printers use ribbon cartridges that must be replaced after one ribbon pass. At about $13 each, these cartridges could amount to a sizable expense if you do a lot of word processing. Other printers use regular typewriter ribbons that reverse direction after each pass. Good for many passes, these ribbons sell for as little as $3 each.

Also, should you choose roll, fanfold, or cut-sheet paper? Printers handle roll and cut-sheet paper with a friction-feed mechanism, where a platen moves the paper by pressing against it. During long print runs, friction-fed roll paper can slip out of alignment. Cut-sheet paper, while not as prone to slipping, requires that you be on hand to feed the individual sheets into the printer unless you buy an expensive automatic feeder.

Tractor (or pin-feed) mechanisms eliminate both problems. Tractor sprockets, or pins at the platen's ends, advance continuous fanfold paper by using holes along the paper's edges. The paper can't slip (except sometimes off the sprockets) and doesn't have to be fed manually.

Check with your vendor to determine which types of paper drive are standard for the printers you're considering and which are optional.

Another item to bear in mind is the printer's interface. Whether the interface is serial, parallel, IEEE-488, current-loop, or a combination, the most important thing to remember is that your computer must also have the same kind. Sound obvious and simple? Sometimes it is, and sometimes it isn't—even with like interfaces on printer and computer, you might still have to overcome small differences in communications codes. Also, some computers and printers have ports for several interfaces. The interface used is selected with a manual or software switch.

I learned how tricky interfaces can be when I bought my computer and printer. I wanted the printer's dot-addressable graphics, stored on optional plug-in PROMS (firmware, or software stored on chips). Before shipping my hardware, the distributor installed the PROMs in the printer, then discovered they would not work with the computer's standard serial interface. The vendor then had to order a parallel interface cable.

If I had tried to install the PROMs myself after receiving the printer, I may never have figured out what was going on. Moreover, I was lucky my computer had both serial and parallel ports.

The moral of my story, and a good one to follow when buying a printer, is to get it from a vendor who will test it out on a computer like yours, while you observe and take notes. Of course, this advice precludes mail-order shopping, but I know of no more dangerous way to buy electronic equipment than through the mail—except maybe under misty lamplight on a city street corner. □

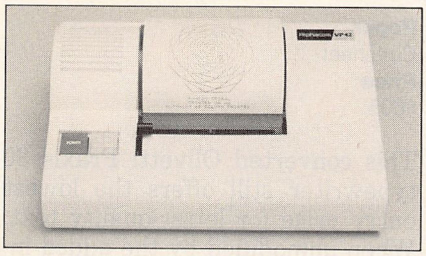
The Buyer's Guide

A gallery of the Top 40 printers for under $1000

by David B. Powell

Rather than give you page after page of company specifications on all the printers available for personal computers, we've decided to present this showcase of the Top 40 printers, complete with summaries of each one's important specifications and capsule reviews stressing the major strengths and weaknesses of each machine. The printer specifications, which we've defined in the preceding article, include:

- Technology—indicates whether the printer is based on a thermal, electrosensitive, impact dot-matrix, ballpoint pen, fully formed character, or ink-jet print head
- Graphics—the maximum graphics resolution in dots per inch (horizontal by vertical)
- Color Output—the number of ribbon or ink colors that can be printed ("No" means the printer produces only black-and-white output)
- Maximum Print Speed—the fastest rate of text output in characters per second (speed is generally slower in enhanced or correspondence-quality modes)
- Maximum Characters Per Line—usually not the printer's normal character density but the densest (most compressed) text mode
- Character Quality—the printer's normal (not expanded or compressed) printed character, whether dot-matrix, letter-quality, or vector (drawn by ballpoint head)
- Interfaces—includes both standard and optional
- Paper—indicates both standard and optional support for friction-feed (cut-sheet and roll) and tractor-feed (fanfold) paper
- Price—basic price for the printer or printer family (options add to this price)



Alphacom VP42

Technology
Thermal

Graphics
70 by 70

Color Output
No

Maximum Print Speed
80 characters per second (cps)

Maximum Characters Per Line
40

Character Quality
5 by 7

Interfaces
Commodore VIC-20

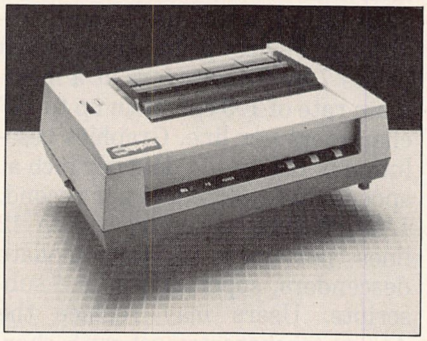
Paper
4½-inch roll or fanfold

Price
$199

Compatible with the VIC-20, the VP42 is a quiet little thermal printer with styling that matches the VIC-20's. Its 256-character set includes all the VIC-20's special characters, so users can print out card pips, graphics bar symbols, shading, cross-hatching, and checkerboarding. The VP42 can also print letters and special symbols in reverse (white on black). (It would be nice if the VP42 could do the same with numbers.)

In addition to packaging printers for both original equipment manufacturers and retail customers, Alphacom is the North American distributor for Olivetti printer mechanisms, so you'll see other printers with speed and print quality like the VP42's. What you don't see elsewhere are the special features Alphacom throws in to entice Commodore users. Included with the VP42 are five VIC programs on cassette: a 40-column Word Processor, graphics Sketch Pad, computer-art program named Kaleidoscope, Record Keeper, and Screen Printer. In addition, VIC-20 users get *Compute*! magazine's *First Book of VIC* (1982) and an excellent printer manual. The VP42 also performs a self-test on power-up.

Recently the firm introduced the model 40/2 ($199), which is compatible not only with the VIC-20 but with the Commodore 64; Atari 400, 800, and 1200; and TI-99/2 and -99/4.



Apple Dot Matrix Printer

Technology
Impact dot-matrix

Graphics
160 by 144

Color Output
No

Maximum Print Speed
120 cps

Maximum Characters Per Line
136

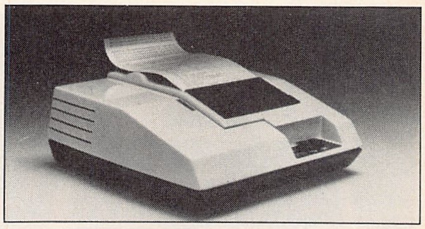
Character Quality
7 by 9

Interfaces
Centronics

Paper
Cut-sheet, roll, fanfold up to 8 inches wide

Price
$695

Like a number of other companies, Apple Computer Inc. has recently come out with a printer that's essentially a C. Itoh printer lookalike. Although a few of the features on the Apple Dot Matrix Printer differ, most are exactly the same as those found on the C. Itoh Prowriter. The Apple printer works with an Apple II Plus with a II PIC card or an Apple III with a UPIC card. For a full description of the features available on Apple's printer, take a look at the review of the C. Itoh Prowriter that appears later in the Buyer's Guide.



Axiom EX401

Technology
Electrosensitive

Graphics
Block characters

Color Output
No

Maximum Print Speed
192 cps

Maximum Characters Per Line
64

Character Quality
5 by 8

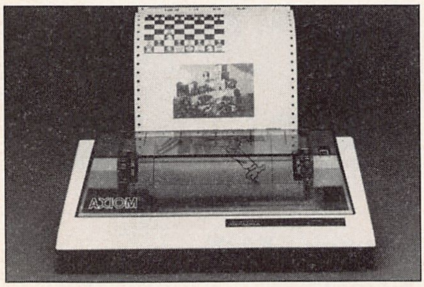
Interfaces
Centronics, RS-232C, 20mA, IEEE-488

Paper
5-inch roll

Price
$549

The lowest-cost model in Axiom's electrosensitive family, the EX401 handles the ASCII 96-character set; the model 401B offers 128 additional symbols and foreign characters. The printer breaks down into four plug-in modules for easy servicing. An input buffer is available for either 40 or 100 characters. Other electrosensitive printers from Axiom include the $849 EX420, $699 model 1601, and $999 model 1620.

The EX420 uses a 24-electrode print head to print up to sixty-four 11 by 16 characters per line at a maximum rate of 384 cps. Graphics resolution is 144 by 144 dots per inch at speeds up to 64,512 dots per second. Models 1601 and 1620, unlike the EX400 family, use 8½-inch roll paper. The 1601 prints 5 by 8 characters at a rate of 3 lines per second (up to 240 cps) and supports block-graphics characters. The 1620 prints 11 by 16 characters at a maximum rate of 6 lines per second (up to 960 cps). Graphics resolution is 144 by 144 dots per inch at speeds as fast as 80,640 dots per second.



Axiom/Seikosha GP-100

Technology
Impact dot-matrix
Graphics
72 by 72
Color Output
No
Maximum Print Speed
30 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
Centronics, RS-232C, TTL, 20mA, IEEE-488, plus computer-specific
Paper
Fanfold up to 9½ inches wide
Price
$266

In addition to its electrosensitive printers, Axiom also supplies impact dot-matrix printers, some of which, such as the GP-100 and -250X, are of novel Japanese design. The character matrix is set down one dot at a time by a single Uni-Hammer head, which drives the paper against a rotating platen studded with spines. While this print head must have been tough to engineer, it means that output can be completely software controlled so you can mix graphics, different sizes of characters, underlining, multipass enhanced text, and special characters all on the same print line. The GP-100 supports the basic ASCII 96-character set.

The GP-100's bigger brother, the $339 GP-250X Graphics Printer, handles up to 128 ASCII characters along with 64 additional user-defined characters. The GP-250X also takes tractor-feed plain paper up to 9½ inches wide but prints 5 by 8 characters at 50 cps. The GP-250X's real strength is graphics. Its graphics resolution is also 72 by 72, but note these standard features: memory for storing up to four print sequences, print position addressable in character or dot units, software-selectable line-feed spacing, and selectable horizontal spacing.

Next in Axiom's impact dot-matrix line are the $699 IMP-3 and $749 IMP-4, which use a more traditional 9-wire print head. Each prints 7 by 9 characters at a maximum rate of 100 cps, with up to 137 characters per line. Graphics resolution is 144 by 144 dots per inch at speeds up to 4096 dots per second. Line spacing varies from 6 to 12 lines per inch to accommodate descenders, superscripts, and subscripts. Users may replace the ASCII 96-character set with characters of their own design. The standard print buffers hold 512 characters (optional buffers hold 2K bytes, or characters). Both IMP printers handle sheet and roll paper up to 8½ inches wide; the IMP-4 handles fanfold paper up to 9½ inches wide as well.

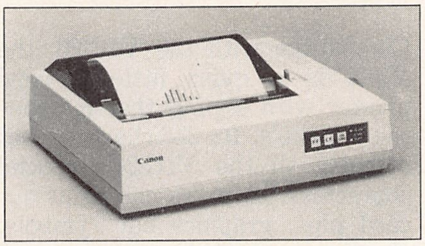
BYTEWRITER

Bytewriter O-30

Technology
Fully formed impact
Graphics
No
Color Output
No
Maximum Print Speed
12 cps
Maximum Characters Per Line
165
Character Quality
Letter-quality
Interfaces
Centronics, plus computer-specific cables
Paper
Cut-sheet
Price
$695

This converted Olivetti Praxis 30 typewriter still offers the lowest entry price for letter-quality text. When unmodified by the added interface box, the Praxis can still be used and serviced as a regular typewriter.

Character spacing is switch-selectable for 10, 12, or 15 characters per inch. You can change fonts simply by inserting any of about twenty 100-character Olivetti daisy wheels. The keyboard contains 44 alphanumeric keys, plus 16 command/function keys. A switch-selectable second keyboard has foreign symbols. When used as a typewriter, the Bytewriter can erase characters by using a lift-off correction ribbon. The Bytewriter also includes self-test software.



Canon A-1200 Dot Impact Printer

Technology
Impact dot-matrix
Graphics
960 dots per line
Color Output
No
Maximum Print Speed
120 cps
Maximum Characters Per Line
136
Character Quality
9 by 7
Interfaces
Centronics
Paper
Roll and cut-sheet up to 8½ inches wide, fanfold up to 10 inches wide
Price
$595

Introduced in November 1982, the A-1200 prints both 9 by 7 and high-

AURA 5

ADVANCED, yet so simple to learn and use, AURA 5 is the ultimate in microcomputer software. With a menu driven, fill in the blank user interface, the carefully integrated capabilities of AURA 5 make your productivity sparkle. At the heart of AURA 5 is a comprehensive Information Management System that enables you to quickly organize and use your information. With free form screen design and report generation capabilities, you can design your own screens and develop reports exactly the way you want them to appear. AURA 5 also gives you the capabilities of word processing, business graphics, and spreadsheet analysis. The communications options enable you to transfer information to and from other micro or mainframe computers. The AURA 5 family of integrated software products will soon be available for 8086, 8088 and 68000 CPU based microcomputers.

Communications

Electronic Spreadsheet

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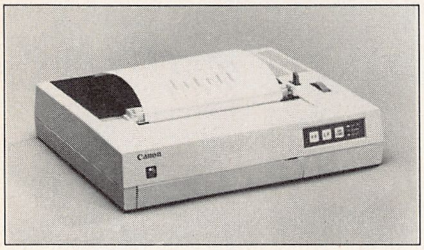
Circle 145 on inquiry card.

THE INNOVATORS IN MICROCOMPUTER SOFTWARE resolution 16 by 16 matrices for the complete ASCII 128-character set. Characters can be spaced at 40, 80, or 136 characters per line at 6 or 10 lines per inch. Text printing is bidirectional at a maximum rate of 120 cps. Unidirectional graphics printing is either 480 or 960 dots per line at a rate of 5760 dots per second. Backing text and graphics printing rates is an input buffer that holds 1 line of text or 1920 bytes of graphics.



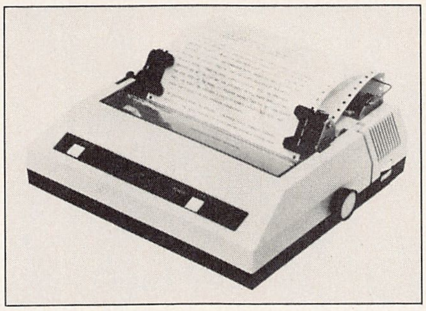
Canon Color Printer A-1210

Technology
Drop-on-demand ink-jet
Graphics
640 dots per line
Color Output
4 mixable
Maximum Print Speed
40 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
Centronics
Paper
Plain roll up to 8½ inches wide
Price
$795

Also introduced last November, the Canon A-1210 brought drop-on-demand color ink-jet printing to the less-than-$1000 printer market. The A-1210 can directly produce seven colors (yellow, blue, red, green, cyan, magenta, and black) from a four-nozzle print head. Linked with the nozzles is a unique dual-cassette ink supply. One cassette contains the three primary colors; the other cassette contains only black ink. The dual-cassette is designed to conserve ink, especially when you're printing only black-and-white text or graphics. Cassette life is estimated at about 3.5 million characters per color.

The A-1210 prints both standard and enlarged ASCII upper- and lowercase characters at a rate of 40 cps, with a density of 80 or 40 characters per line, respectively. Graphics resolution is 560 dots per line or 640 dots per line in a screen-copy mode. Graphics are printed at 2600 dots per second; text is printed at 12 characters per inch and 6 lines per inch.

The A-1210 buffers input in both text and graphics modes. The buffer holds one line of text or up to 640 bytes of color-graphics output.



Centronics 150 Series

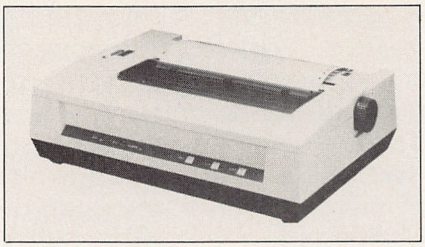
Technology
Impact dot-matrix
Graphics
No
Color Output
No
Maximum Print Speed
150 cps
Maximum Characters Per Line
216
Character Quality
7 by 9
Interfaces
Centronics, RS-232C
Paper
Fanfold up to 15 inches wide
Price
$795

After my conversation with a Centronics representative, I faced the unpleasant prospect of omitting this company once synonymous with printers. My contact claimed the company had stopped actively selling printers to end users. Instead, the firm was pursuing OEM (original equipment manufacturers) sales. But because the company does have an OEM single-printer price, I decided to include the 150 Series in our guide.

The models 150, 152, and 159 all print up to 150 cps at 10 characters per inch. At 16.36 characters per inch, these printers can squeeze 130, 216, and 132 characters, respectively, into a line. You might expect the model 159 to print more characters per line than the 152, but the 159 is essentially a demand-document printer, able to handle 5-part forms (invoices, tickets, and so forth) to within 1 inch of the tear line. All models provide 5, 8.18, 10, and 16.36 characters per inch and are bidirectional and logic seeking at 10 characters per inch.

Series features include adjustable tractors, self-test, and variable top-of-form control. All models print the ASCII 96 upper- and lowercase character set; international characters are available.

The company also offers an interesting graphics printer, the model 122. It produces 8 by 11 characters—available in seven fonts—at a bidirectional rate of 120 cps. Graphics printing is unidirectional at 70 by 72 resolution. Line spacing is selectable at 6, 9, 12, or 18 lines per inch. A 6-pin graphics mode makes the model 122 compatible with existing model 739 applications. An additional 8-pin mode increases print speed by about 20 percent.



C. Itoh Prowriter

Technology
Impact dot-matrix
Graphics
160 by 44
Color Output
No
Maximum Print Speed
120 cps

Plug your Osborne™ into the telephone. Say hello to the information age.

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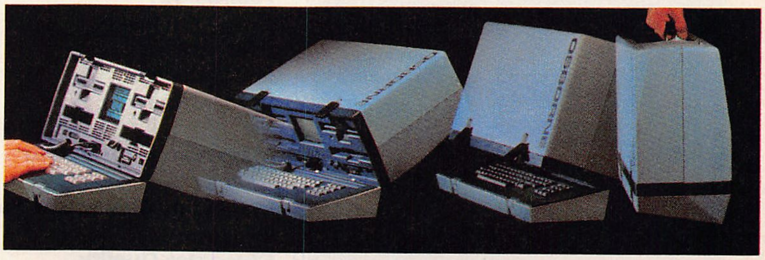

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Circle 108 on inquiry card.

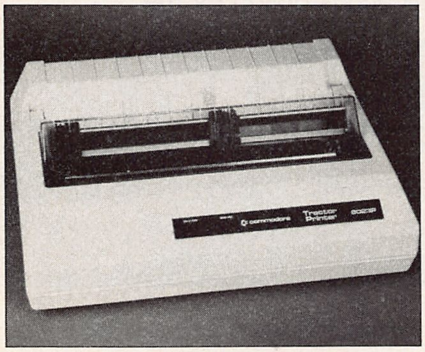
Maximum Characters Per Line
136
Character Quality
N by 9
Interfaces
RS-232C, 20mA, TTL parallel
Paper
Fanfold, roll, cut-sheet up to 10 inches wide
Price
$775

If you take a good look at this photograph, you'll soon learn to spot the Prowriter with a number of other companies' labels attached. These days, that seems to happen with a lot of Japanese printers.

C. Itoh uses synthetic ruby print-wire guides, instead of more conventional metal guides, for longer life and greater firing accuracy. The Prowriter supports five fonts and eight character sizes, two of which are proportional; fonts can be mixed during a single line pass.

An onboard microcomputer supports bidirectional text and graphics, forward and backward roll or tractor feed, automatic horizontal and vertical tabs, and line spacing down to 1/144 of an inch. The Prowriter also includes a standard 1K-byte input buffer.

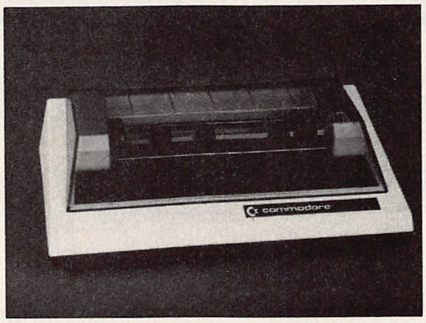
C. Itoh's $995 Prowriter II impact dot-matrix printer shares the above specifications but prints up to 231 characters across paper up to 15½ inches wide. The Prowriter II's input buffer is 3K bytes.



Commodore 8023P Tractor Printer

Technology
Impact dot-matrix
Graphics
Unspecified
Color Output
No
Maximum Print Speed
150 cps
Maximum Characters Per Line
136
Character Quality
6 by 8
Interfaces
Commodore
Paper
Tractor-feed
Price
$795

The CBM 8023P puts out its 256-character set at the highest speed available from a less-than-$1000 Commodore printer. The 8023P prints bidirectionally and has approximately 20 user-controllable printer functions. Another tractor-feed printer, the company's $495 CBM 4022, can print up to 80 characters per line at a maximum rate of 80 cps and provides full PET graphics output.



Commodore VIC 1525P

Technology
Impact dot-matrix
Graphics
VIC characters
Color Output
No
Maximum Print Speed
30 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
VIC-20 or Commodore 64
Paper
Tractor-feed up to 9½ inches wide
Price
$395

This model also supports the Commodore 256-character set. Its 300-bit-per-second data transmission rate is backed with a 90-character input buffer. Commodore introduced this model along with the model 8023P last year.

EXECUPORT
EXECUPORT

CTSI Execuport 400 Series

Technology
Impact dot-matrix
Graphics
120 by 60
Color Output
No
Maximum Print Speed
80 cps
Maximum Characters Per Line
132
Character Quality
5 by 7
Interfaces
RS-232C, 20mA
Paper
Roll
Price
$795

Computer Transceiver Systems Inc. (CTSI), known for portable thermal printers, also produces this family of 12-pound, portable, impact dot-matrix printers designed primarily for communications applications. The family includes the $795 model 420, $995 model 430, and $1195 model 440. All models print upper- and lowercase ASCII characters at 14 densities ranging from 5 to 20 characters per inch. A stepper motor provides forward and reverse line feed at 2, 3, 4, 6, 8, or 12 lines per inch. All three models also include backspace, operator-adjustable margins, and 1, 2, or 3-copy output.

Circle 128 on inquiry card. →

Don't let price get in the way of owning a quality printer.

Adding a printer to your computer makes sense. But deciding which printer to add can be tricky. Do you settle for a printer with limited functions and an inexpensive price tag or buy a more versatile printer that costs more than your computer? Neither choice makes sense.

Here's a refreshing option—the new, compact STX-80 printer from Star Micronics. It's the under $200 printer that's whisper-quiet, prints 60 cps and is ready to run with most popular personal computers.

The STX-80 has deluxe features you would expect in higher priced models. It prints a full 80 columns of crisp, attractive characters with true descenders, foreign language characters and special symbols. It offers both finely detailed dot-addressable graphics and block graphics.

And, of course, the STX-80 comes with Star Micronics' 180 day warranty (90 days on the print element).

The STX-80 thermal printer from Star Micronics. It combines high performance with a very low price. So now, there is nothing in the way of owning a quality printer.

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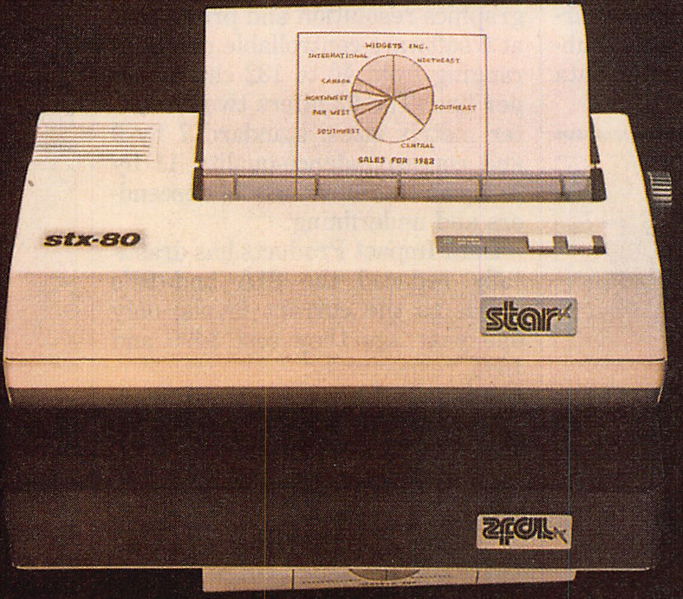


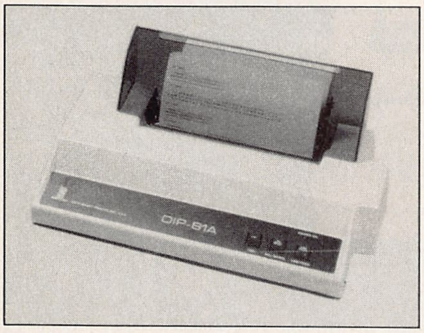
The new STX-80 printer for only $199.*

*Manufacturer's suggested retail price.

The Execuport 420 is a receive-only printer for local-peripheral uses. It supports the family's highest online transmission rate—up to 9600 bits per second (bps). The model 430 adds a 62-key keyboard and provides a full ASCII 128-character set. Operating characteristics, such as data transmission rate, data pacing, and answerback, can be set through the keyboard or under program control and stored in nonvolatile memory. The maximum communications rate is 1200 bps with a 20-character, programmable answerback message.

To these features, the model 440 adds an internal Bell 103 modem with an optional acoustic coupler for two-way communications over telephone lines. The modem handles both originate and auto-answer operation. It offers keyboard dialing of telephone numbers with single-key accelerated dialing and an internal speaker for call progress signals. The model 440's Bell modem operates at rates up to 300 bps.

CTSI's established line of portable printing terminals offers features such as wide and narrow carriages, graphics, nonvolatile bubble memory, and automatic data encryption.



Data Impact Products DIP-81A

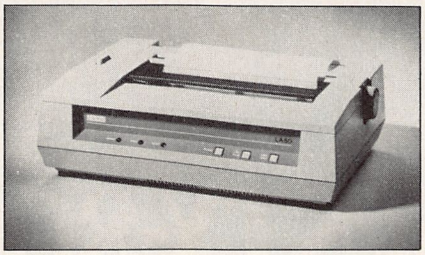
Technology
Impact dot-matrix
Graphics
No
Color Output
No
Maximum Print Speed
100 cps
Maximum Characters Per Line
80
Character Quality
7 by 7
Interfaces
Centronics, RS-232C, 20mA
Paper
Cut-sheet, roll, fanfold up to 8½ inches wide
Price
$369

The company recently trimmed down its product line to only two models: the DIP-81A and the DIP-92 ($399). Although the 81A does not offer dot-addressable graphics, it does provide switch-selectable ASCII 96 upper- and lowercase characters and Baudot codes.

Both the 81A and 92 contain a cooling fan—a good feature because both can print continuously, with a buffer of up to 2K bytes accepting data during output. Each model features reliable single-circuit-board construction, an expanded 14 by 7 character matrix, and software-selectable density of 5 or 10 characters per inch.

The 92 can produce up to 72 by 72 graphics resolution and prints text at 6 software-controllable densities ranging from 40 to 132 characters per line. The 92 offers two character matrix sizes: standard 7 by 9 and correspondence-quality 11 by 9. It can therefore handle descenders and underlining.

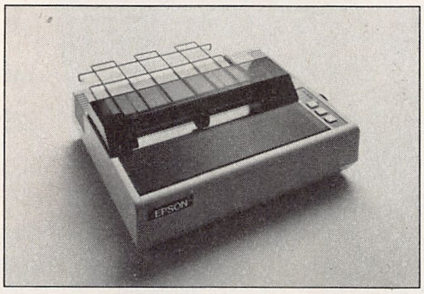
Data Impact Products has drastically reduced the 81A and 92's prices to the current levels; only one year ago they cost $499 and $695, respectively.



Digital Equipment LA50

Technology
Impact dot-matrix
Graphics
133 by 72
Color Output
No
Maximum Print Speed
100 cps
Maximum Characters Per Line
132
Character Quality
7 by 9
Interfaces
DEC, RS-232C
Paper
Cut-sheet, roll, fanfold up to 10 inches wide
Price
$850

Introduced with DEC's Rainbow Personal Computer, the LA50 both reproduces a bit-mapped VT100 graphics image and prints up to 250 characters, including the ASCII 96-character set, VT100 special characters, line-drawing characters, and 11 foreign fonts. Six character densities range from 5 to 16.5 characters per inch. An enhanced print mode produces near-letter-quality 13 by 9 characters at a respectable rate of 50 cps. The 9-wire print head produces true descenders, underlining, and boldface text. Line spacing ranges from 2 to 8 lines per inch. Internal self-test routines check both electronics and printer operation.



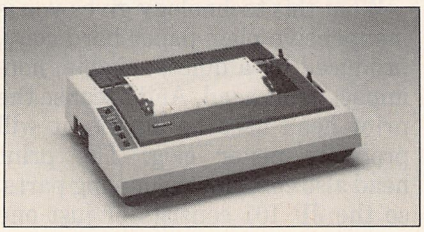
Epson MX-80

Technology
Impact dot-matrix
Graphics
120 by 216
Color Output
No
Maximum Print Speed
80 cps
Maximum Characters Per Line
132

Character Quality
9 by 9
Interfaces
Centronics, RS-232C, IEEE-488
Paper
Fanfold up to 10 inches wide
Price
$494

The MX-80, like Epson's MX-80F/T and MX-100, can also be seen sporting many other manufacturers' labels. While the MX-80 offers only adjustable tractor feed, the others offer friction feed with a snap-in adjustable tractor.

The 80F/T and 100 print standard 9 by 9 characters at rates of 80 and 100 cps, respectively. In compressed mode, the 80F/T and 100 can pack up to 132 and 233 characters per line, respectively. All models print standard characters, plus double-height 9 by 18, emphasized 18 by 9, and emphasized, double-height 18 by 18 characters. Standard Graftrax-Plus firmware supports two bit-mapped graphics resolutions: 60 by 216 and 120 by 216 dots per inch. Epson printers handle subscripts, superscripts, single-pass underlining, and italics. Fonts include the ASCII 96-character set, plus foreign and user-defined characters.

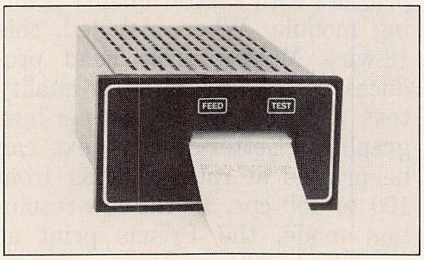


Facit Dataroyal 4510

Technology
Impact dot-matrix
Graphics
120 by 72
Color Output
No
Maximum Print Speed
120 cps
Maximum Characters Per Line
132
Character Quality
9 by 9
Interfaces
Centronics, RS-232C, V.24, current loop
Paper
Roll, cut-sheet, fanfold up to 11 inches wide
Price
$695

Apparently unique to this new printer is its set of 64 Viewdata (Prestel) block-graphics characters. If Britain's Prestel videotext networks take off in this country, Facit Inc., at least, won't have to reprogram its printer's ROM (read-only memory).

In addition to the Prestel characters, the 4510 provides dot-addressable graphics at three resolutions. The 4510 prints the ASCII 96-character set plus eight foreign fonts using either a 9 by 9 dot matrix (at 10, 12, and 17 characters per inch) or a high-resolution 9 by 15 matrix (at 10 characters per inch or proportionally spaced). The 4510 also offers bidirectional printing, software-selectable line spacing at 6 or 8 lines per inch, and graphics line feed of 7/72 of an inch. The printer supports a 2K-byte buffer with data-manipulation firmware.

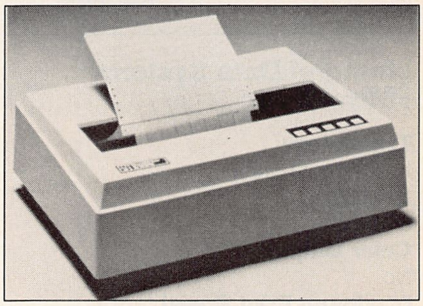


Gulton Microprint-20

Technology
Thermal
Graphics
No
Color Output
No
Maximum Print Speed
40 cps
Maximum Characters Per Line
20
Character Quality
5 by 7
Interfaces
TTL, RS-232C, 20mA, parallel
Paper
2¼-inch roll
Price
$650

The company lists the Microprint-20 as either an OEM (original equipment manufacturer) or retail printer, in spite of its panel-mount design. It features a fixed print head capable of printing a full-line dot row. An ASCII 64 uppercase character set can be printed emphasized, half-height, or double-height. Built in are self-test firmware, serial and parallel interfaces, and an onboard clock. Communication rates range from 110 to 1200 bits per second (bps).

The company also offers the $1090 Microplot-44 and $1945 Microplot-88 thermal text/graphics printers in either OEM or retail chassis. Both printers support the ASCII 96 upper- and lowercase character set, 62 by 62 bit-mapped graphics, and online communications at a maximum rate of 9600 bps. The models 44 and 88 print up to 44 and 84 characters per line, respectively, at rates up to 88 and 120 cps across 5- or 8¾-inch-wide roll paper. Both use fixed, line-wide print heads, so mechanical reliability should be higher—and vertical dot alignment, more accurate—than with a moving thermal head. Text and graphics can be mixed; graphics include dot and vector plotting and shading.

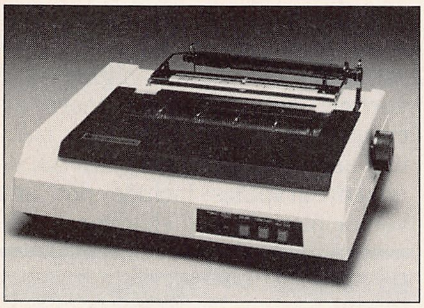


Hi-G 9/80PS

Technology
Impact dot-matrix
Graphics
72 by 72
Color Output
No
Maximum Print Speed
150 cps
Maximum Characters Per Line
136

Character Quality
9 by 9
Interfaces
Selectable Centronics, RS-232C, 20mA
Paper
Roll, cut-sheet, fanfold up to 10 inches wide
Price
$995

Designed for business and demand-document applications, the 9/80PS prints the ASCII 96-character set, along with characters your computer generates or you design yourself, at densities ranging from 10 to 16.5 characters per inch. It also handles double-width and emphasized characters, superscripts, and subscripts. To support communication rates up to 9600 bits per second, you can configure the printer with input buffers ranging from 350 to 3400 characters. As of this writing, the company intended to raise the price of the 9/80PS by $55.

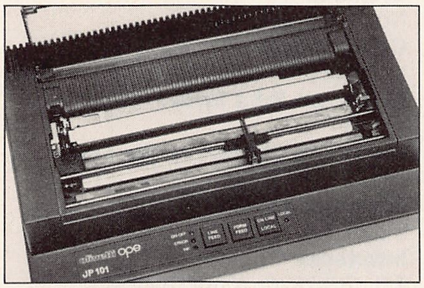


Integral Data Systems Microprism

Technology
Impact dot-matrix
Graphics
84 by 84
Color Output
No
Maximum Print Speed
110 cps
Maximum Characters Per Line
132
Character Quality
9 by 18
Interfaces
Selectable Centronics, RS-232C
Paper
Fanfold, roll, cut-sheet up to 9 inches wide
Price
$799

The Microprism's staggered, 9-wire Maisey print head produces the ASCII 96-character set at a maximum rate of 110 cps in the 9 by 18 low-resolution mode or at a maximum of 75 cps in the 9 by 24 letter-quality mode. Both text modes and 84 by 84 dot-per-inch graphics can be mixed on a single line. Standard capabilities include proportional spacing, justification, backspace and overstrike, and automatic horizontal and vertical tabs. Fixed text densities include 10, 12, and 16.8 characters per inch, plus double-wide characters. In the graphics mode, seven of the head's nine pins are addressed by one bit of each byte received, so users can directly control dot-plot combinations. Communications rates range from 300 to 9600 bits per second, backed by a 1.4K-byte buffer. Printer parameters may be set manually through DIP (dual-inline pin) switches in the computer or through host-generated signals.

Higher up in its product line, Integral Data Systems has enhanced its just-over-$1000 4-color Prism printers with a letter-quality printing module. When installed, this 18-wire Maisey print head produces both 18 by 36 letter-quality text and 168 by 168 dot-per-inch graphics. Letter-quality text can be printed at rates ranging from 100 to 150 cps. In the low-resolution mode, the Prisms print at rates up to 200 cps. Prism printers use either of two 4-color ribbon cartridges: red/blue/green/black and cyan/magenta/yellow/black.



Irwin/Olivetti JP 101

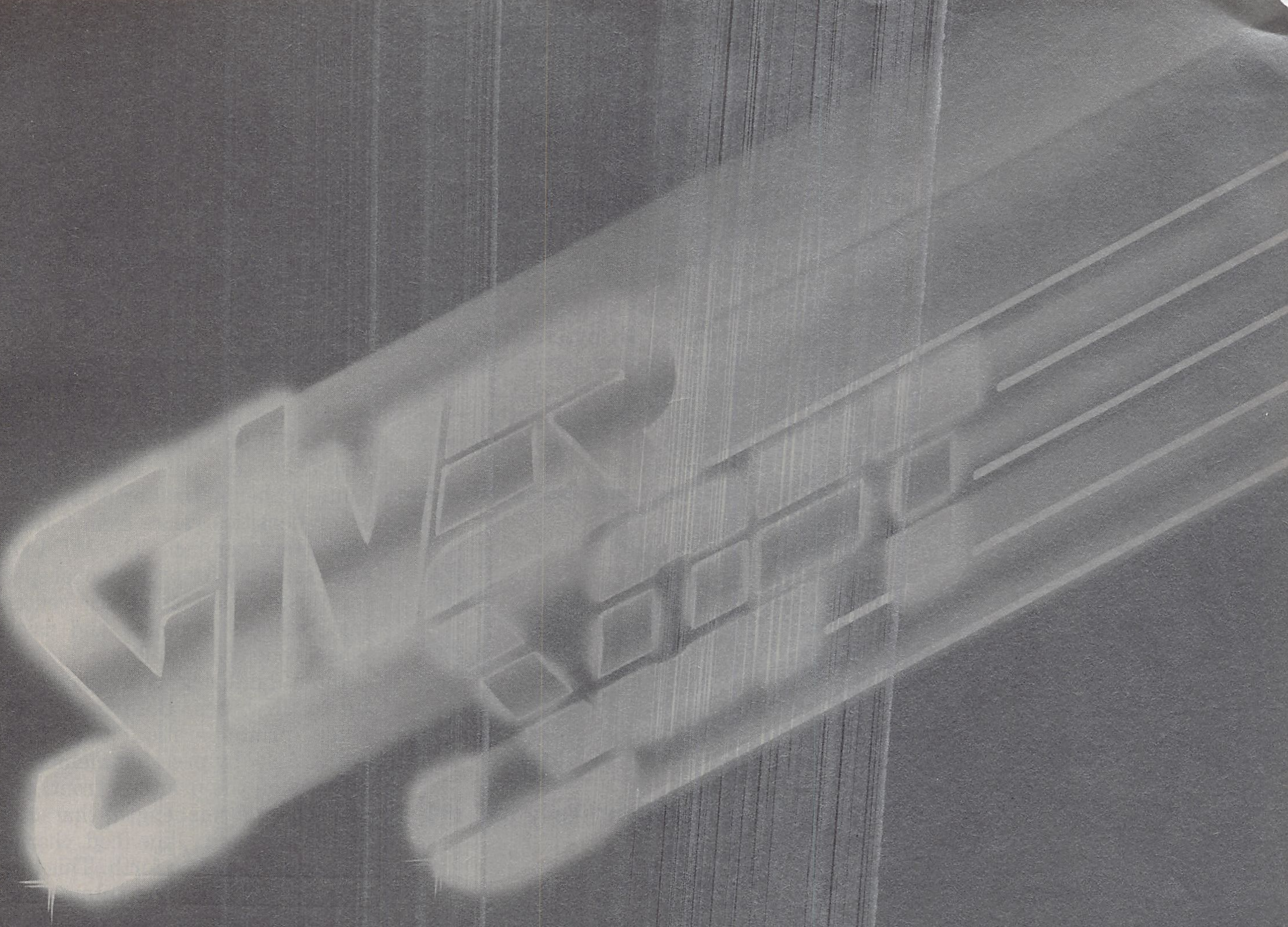
Technology
Solid ink-jet
Graphics
110 by 110
Color Output
No
Maximum Print Speed
80 cps
Maximum Characters Per Line
146
Character Quality
7 by 7
Interfaces
Centronics, RS-232C, current-loop
Paper
Roll up to 8½ inches wide, fanfold up to 9 inches wide
Price
$499

The JP 101 uses a unique, patented print head and last November marked the entrance of ink-jet printers into the less-than-$1000 arena. The JP 101's print head is a plug-pin 1.875-inch-long glass ampule containing a spring-loaded solid-ink rod (graphite with resin binders) and an end-of-ink sensor. A high-potential (3 to 4 kilovolt) spark vaporizes the rod's tip into fine graphite powder. Behind the paper, a charged platen pulls this powder to its single-dot impact. The ampule, the printer's only consumable item, delivers up to 200,000 characters and costs only $1.

What this technology gives you is inexpensive plain-paper hard copy, produced by a quiet, reliable, non-impact print head. And because the print head uses no liquids, it will probably never clog. The print head also contains no moving parts, so the JP 101 consists of just one circuit board, a power supply, paper-advance mechanism, and horizontal and vertical print-head stepper motors. To support the printer's dot-addressable graphics, these motors can move the head with .009- by .0045-inch resolution.

The JP 101 produces eight fonts at 10, 12, or 18.25 characters per inch. Text enhancements include double-height, double-width, and three underline styles: normal, double, and dotted. Because this printer does not use a fixed-height or fixed-width matrix print head, it

Circle 59 on inquiry card. ➞



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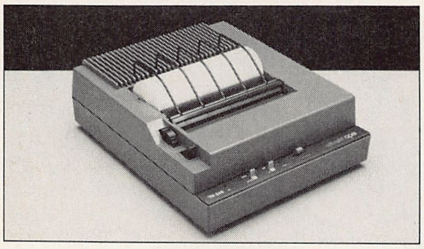
permits programmable vector-like plotting, with no vertical foreshortening. Bit-mapped graphics can be printed double-sized, normal, or reverse (white on black). Internal switches set font, forms length, and data communications rates. Console switches control form feed, line feed, online/local status, and print darkness. The printer includes self-test firmware plus a roll-paper cutting edge on the cover. The 4.5- by 15- by 10-inch JP 101 weights only 11 pounds. Now, if Irwin/Olivetti can just figure a way to color its solid ink . . . .

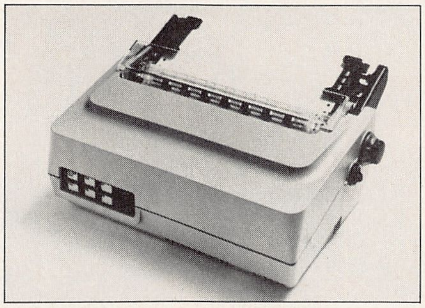


Irwin/Olivetti TH 240

Technology
Thermal
Graphics
70 by 70
Color Output
No
Maximum Print Speed
320 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
Parallel, RS-232C, 20mA
Paper
Roll up to 8¾ inches wide
Price
$850

Thermal printers such as the TH 240 serve very well as fast, quiet, hard-copy devices—if you don't mind using thermal paper. And speed is one of the TH 240's fortes: with a print speed of 320 cps, it can print the contents of a full 24-line by 80-character display screen in 6 seconds. In the graphics mode, it can print about 16,816 dots per second with 70 by 70 resolution. The printer supports the ASCII 96 upper- and lowercase character set, as well as 7 foreign fonts, at the rate of 10 characters per inch and with a spacing of 6 lines per inch.

The TH 240 includes self-test firmware and a 2K-byte buffer, expandable to 4K bytes. Front-panel switches control print darkness, online/local status, and autotest/line feed. For servicing, the printer breaks up into three replaceable subassemblies.



Mannesmann Tally MT 160

Technology
Impact dot-matrix
Graphics
100 by 64
Color Output
No
Maximum Print Speed
160 cps
Maximum Characters Per Line
160
Character Quality
7 by 9
Interfaces
RS-232C or IEEE parallel
Paper
Roll, cut sheet, fanfold
Price
$845

The $845 and $990 sticker prices may make the MT 160 Models I and L seem like the Cadillacs of the less-than-$1000 printer world, but they do boast a Ferrari-like performance like that of machines costing much more. One reason for such performance is the company-manufactured print head, which, in the MT 160L, can transform a 7 by 9 matrix into a 40 by 18 near-letter-quality matrix. The print head produces this 40 by 18 matrix by shifting one-half dot row during a second pass. But in spite of the second pass, the print rate remains a respectable 40 cps. The printers' standard output is bidirectional at 160 cps, but because of accelerated tabbing over blank spaces at 250 cps, the actual rate is higher than 160 cps.

Both models produce two graphics resolutions—50 by 64 and 100 by 64 dots per inch. Both models print the ASCII 96 upper- and lowercase character set, plus eight foreign fonts—either normal or bold. Character densities range from 5 to 20 characters per inch. The MT 160L adds software for proportional spacing, justification, automatic centering, business graphics, and daisy-wheel code compatibility.

Input buffering is available for up to 2K bytes. Both models include print-operation test firmware. Also, by pressing membrane buttons on the printer's front, you can set up forms length, character set, print quality, line feed, character density, and so forth. This process can also be done automatically. Configurability data is stored in nonvolatile memory, so it isn't lost when power is shut off.

These relatively new printers seem to offer a lot of engineering for the price. And they very well might, if experience proves out one last claim: that their solid metal construction, precision machining, noise absorption, and heat dissipation eliminate the need for any periodic maintenance or adjustment. Now, that's a tall order.

Micro Peripherals Printmate 150

Technology
Impact dot-matrix
Graphics
85 by 72

Circle 45 on inquiry card. ⟶

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CR-II ComRiter

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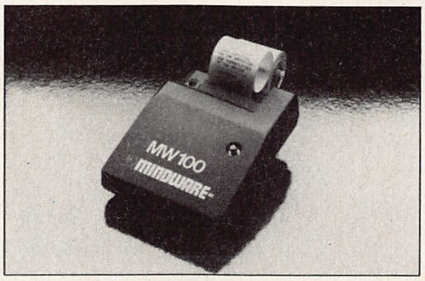
Color Output
No
Maximum Print Speed
150 cps
Maximum Characters Per Line
231
Character Quality
7 by 9
Interfaces
Centronics, RS-232C, IEEE-488
Paper
Fanfold up to 15 inches wide
Price
$995 (Model B1)

Micro Peripherals recently expanded its Printmate 150 into a four-model series. Models A1 and B1 include standard 4K- and 2K-byte input buffers, respectively, while models A2 and B2 include 16K-byte buffers. Models A1 and A2 incorporate a front-panel membrane keypad for configuring forms length, print density, horizontal and vertical tabs, data transmission rate, and character set. These settings are stored in nonvolatile memory, which retains them when power is turned off.

The Printmate 150 supports the ASCII 96-character set, with descenders and underlining, and 3 foreign fonts. You may also develop your own character sets on the computer. Characters are printed at densities of 10, 12, and 17 characters per inch, plus double-wide and 11 by 9 near-letter-quality. Graphics are printed at a resolution of 72 dots per inch (vertical) and selectable 50, 60, 75, 80, or 85 dots per inch (horizontal).

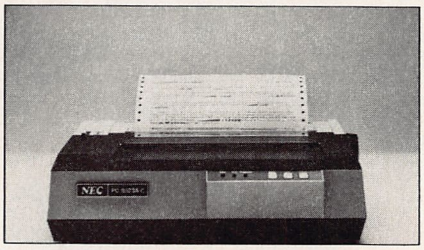
The most unusual feature of the Printmate 150 (and the smaller $599 Printmate 99) is the software driver sold by its manufacturer. The Ap-Pak software driver is available for a growing list of computers, including the Apple II; Beehive; IBM Personal Computer; Zenith A-90, Z-89, and Z-100; TI 99/4; Osborne 1; and other CP/M computers. The Ap-Pak software enables the printer to produce mixed text and graphics, logos, very large characters, white-on-black print, and a staggering array of unusual type styles—including Egyptian hieroglyphs, Old English, Hebrew, Greek, pseudo-oriental, and Olde West fonts (it's nice to see a company with a sense of humor). In addition, some Ap-Pak software interfaces with popular software such as Visiplot. At this writing, the manufacturer claims to have the only printers that can produce the entire IBM Personal Computer graphics character set.



Mindware MW-100

Technology
Impact dot-matrix
Graphics
96 by 72
Color Output
No
Maximum Print Speed
16 cps
Maximum Characters Per Line
16
Character Quality
5 by 7
Interfaces
Timex/Sinclair
Paper
1¾-inch roll tape
Price
$129.95

Last fall, Mindware crashed into Timex/Sinclair's U.S. market with a printer for the TS1000 personal computer. The MW-100 is an impact dot-matrix printer rather than a thermal printer (which uses more expensive paper) like the one Timex/Sinclair has recently introduced. Unfortunately, the MW-100's 16-character print line covers only half of the computer's 32-character display line. It's a masterpiece of adaptive engineering that one of the MW-100's four print modes copies left and right halves of the screen separately. For a full-screen copy, you can tape the two strips together. Or you can choose to alternate left and right half-lines down a single paper tape, with right half-lines indented. A third mode prints full-screen lines for lines up to 16 characters long. A fourth mode prints a respectable 96 software-addressable dots per line (horizontal) by 72 dots (vertical).



NEC 8023A

Technology
Impact dot-matrix
Graphics
160 by 144
Color Output
No
Maximum Print Speed
100 cps
Maximum Characters Per Line
136
Character Quality
7 by 9
Interfaces
Centronics, serial
Paper
Fanfold, cut-sheet up to 10 inches wide
Price
$645

The 8023A produces upper- and lowercase ASCII characters, as well as Greek, mathematical, game, and graphics symbols. Fonts can be mixed on the print line in a single pass. Characters can be spaced at 5, 6, 8.5, 10, 12, and 17 characters per inch and proportionally. Line spacing can be set at 6 or 8 lines per inch and in increments of 1/144 of an inch. The 8023A handles true underlining, reverse line feed, superscripts, and subscripts. A 2K-byte input buffer is standard. The print head contains synthetic rubies to extend head life beyond 100 million characters. According to a company spokesman, NEC engineers have found that the

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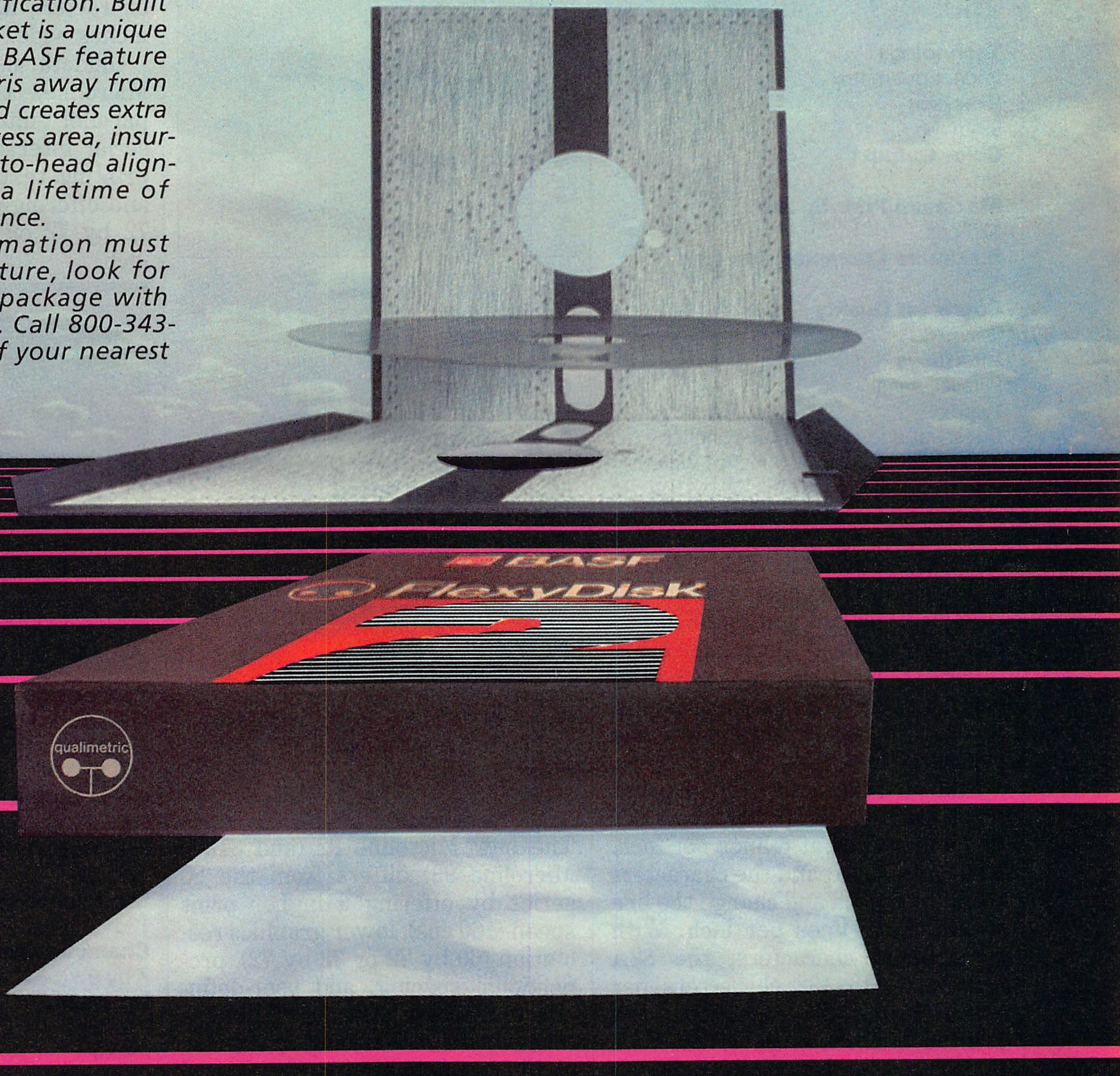

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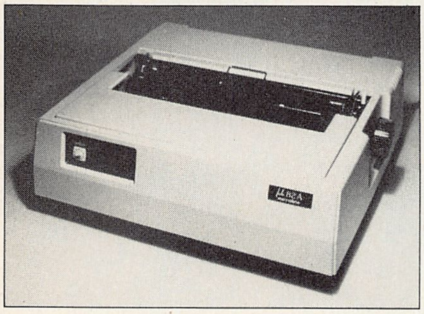
printer is particularly compatible with Micropro's Wordstar word-processing software, which can directly drive all 8023A features, including dot-addressable graphics.



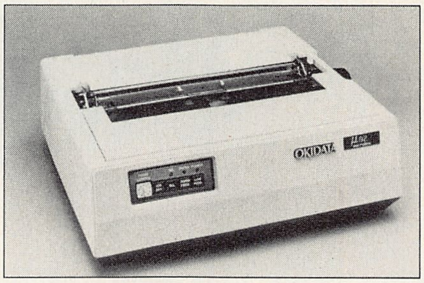
Okidata Microline 82A

Technology
Impact dot-matrix
Graphics
99 by 66
Color Output
No
Maximum Print Speed
120 cps
Maximum Characters Per Line
132
Character Quality
9 by 9
Interfaces
Parallel, serial
Paper
Cut-sheet and roll up to 8½ inches wide; fanfold up to 9½ inches wide
Price
$549

With the Microline 82A, Okidata provides an inexpensive basic unit to which you can add optional features as you need them. Like other Microline printers, the 82A uses regular typewriter-style ribbons, which are easily obtainable and relatively low cost.

Standard characters can be printed at a density of 80 characters per line and spaced at 6 lines per inch. You can also expand the characters to double width and change the line spacing to 8 lines per inch. With compressed characters, the 82A can fit up to 132 characters per line. Standard characters are printed bidirectionally at the rate of 120 cps, and elongated characters are printed at half that rate.

The printer offers upper- and lowercase characters with true descenders, 64 block-graphics characters, and switch-selectable foreign language and TRS-80 character sets. An especially nice option with the 82A is fully dot-addressable graphics that let you create characters of your own design; for this option you'll need to buy the external serial-to-parallel interface. The 82A also offers software-selectable forms feed and vertical tabs; data transmission rates range from 110 to 1200 bits per second. The standard buffer can be expanded to 2K bytes.



Okidata Microline 92

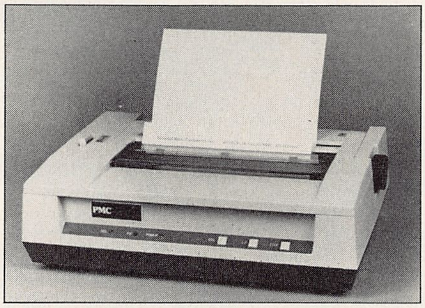
Technology
Impact dot-matrix
Graphics
72 by 72
Color Output
No
Maximum Print Speed
160 cps
Maximum Characters Per Line
136
Character Quality
9 by 9
Interfaces
Centronics, RS-232C, IEEE-488, 20mA
Paper
Cut-sheet up to 8½ inches wide, fanfold up to 9½ inches wide
Price
$699

The new Microline 92 (and $1249 Microline 93) differs from the 80 series by offering a higher print speed (160 cps), lower graphics resolution (60 by 72 or 72 by 72), proportional spacing, and user-definable characters. Also, the 92 offers three types of text output: regular at 160 cps, enhanced at 80 cps, and correspondence-quality at 40 cps. Like the 80 series, the 92 and 93 can produce superscripts, subscripts, descenders, and underlining. The 92's and 93's software-selectable character densities include 5, 6, 8.5, 10, 12, and 17 lines per inch.

Also differing from the earlier Microlines, the 92 supports online rates up to 19,200 bits per second, backed by input buffers that hold up to 4K bytes. Okigraph dot-addressable graphics—once a plug-in option only—is standard on the 92. User controls include forms length and vertical tabs.

The Microline 93 shares the 92's capabilities but can print up to 233 characters across paper up to 16 inches wide.

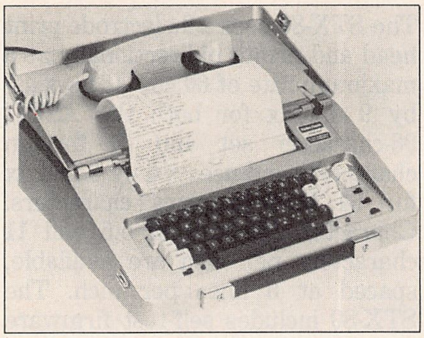
Okidata also offers yet another Microline, the model 84 (with parallel interface, $1395; with serial interace, $1495) capable of printing text at a rate of 200 cps and offering graphics resolution of 72 by 72 or 144 by 144 dots per inch.



Personal Micro Computers DMP-85

Technology
Impact dot-matrix
Graphics
160 by 144
Color Output
No
Maximum Print Speed
120 cps
Maximum Characters Per Line
136
Character Quality
7 by 9
Interfaces
Parallel
Paper
Cut-sheet
Price
$595

Comparable with the C. Itoh Prowriter and NEC 8023 printers, the DMP-85 offers five fonts (at two character densities), two proportional fonts, and 255 characters (including graphics symbols). It provides both regular and expanded widths, boldface, and underlining. Text and bit-mapped graphics can be mixed on a print line. The DMP-85 conserves paper by printing up to 1 inch from the paper's edge. The printer includes a standard 1.3K-byte input buffer.



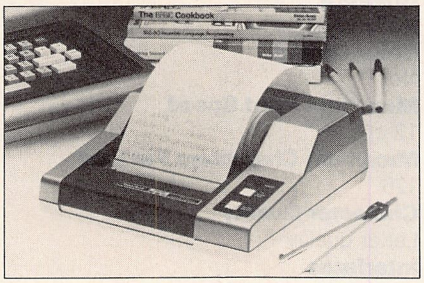
Radio Shack PT-210

Technology
Thermal
Graphics
No
Color Output
No
Maximum Print Speed
50 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
TRS-80, RS-232C
Paper
Roll up to 8½ inches wide
Price
$995

The PT-210 Portable Data Terminal is Radio Shack's first such unit for teletext subscribers. The briefcase-sized unit includes a full keyboard, 100/300-bit-per-second Bell 103A acoustic coupler, and printer. An optional RS-232C interface also lets the unit serve as a local printer/terminal.

The PT-210 prints the ASCII 67 uppercase character set only; it automatically converts all lowercase characters to their uppercase equivalents.

This portable data terminal can be used with the company's TRS-80 Videotext software to communicate with such services as Compuserve, Dow Jones News/Retrieval, Wall Street Journal Highlights Online, U.S. stock exchanges, and the NASDAQ over-the-counter service.

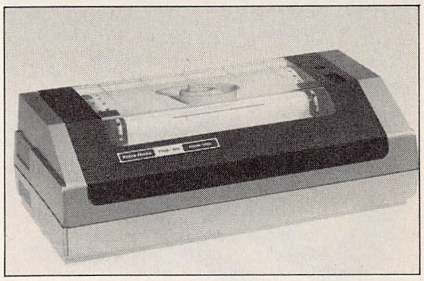


Radio Shack CGP-115 Color Graphics Printer

Technology
Ball-point pen
Graphics
127 by 127 steps per inch
Color Output
4
Maximum Print Speed
12 cps
Maximum Characters Per Line
80
Character Quality
Vector plot
Interfaces
Radio Shack, RS-232C
Paper
4½-inch roll
Price
$250

Compatible with most Radio Shack computers and with the PT-210 Portable Data Terminal, this printer produces charts and text by using four mini-ball-point pens: red, blue, green, and black. The graphics mode offers 0.2-millimeter (mm) step resolution on the 96-mm x-axis. The y-axis is limited only by the amount of paper remaining on the 150-foot roll.

Characters are plotted in 16 widths ranging from 5 to 80 characters per line. The text mode produces 40 or 80 characters per line at a rate of 12 cps. Special graphics commands include backspace, reverse line feed, change color, change print direction, move without drawing, join points, draw axes, and change line styles (with a choice of 16 styles). The unit prints the full ASCII 96-character set.

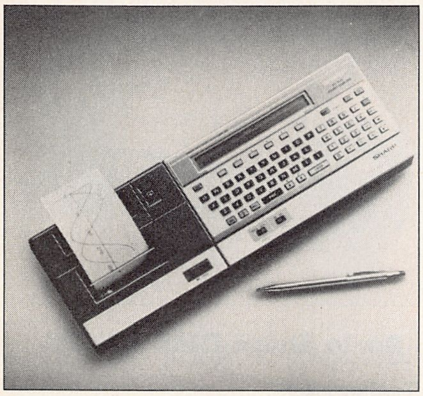


Radio Shack DMP 100/200

Technology
Impact dot-matrix
Graphics
60 by 63/100 by 100
Color Output
No
Maximum Print Speed
50 cps/120 cps
Maximum Characters Per Line
80/132
Character Quality
5 by 7/9 by 9
Interfaces
Parallel, serial
Paper
Cut-sheet, fanfold up to 9½/11 inches wide
Price
$399/$799

Both the DMP 100 and 200 are compatible with the TRS-80 Models I, II, and III and Color Computer. The DMP 100 prints the ASCII 96-character set at a density of 5 or 10 characters per inch at a unidirectional rate of 50 cps. The printer includes a 480-byte input buffer. With an optional screen-print program, the DMP 100 can produce bit-mapped, black-and-white graphics comparable to those on a Color Computer screen. The printer also supports underlining. Users can switch-select either a parallel interface or a 600-/1200-bit-per-second serial interface.

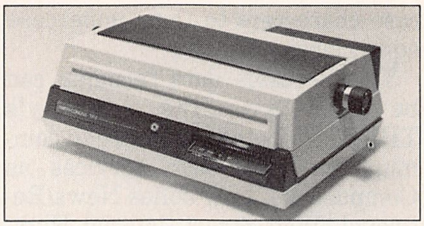
The larger DMP 200 prints the ASCII 96-character set plus 62 special characters bidirectionally at a maximum rate of 120 cps. It also prints a 9 by 9 or 15 by 9 character matrix. Character density ranges from 5 to 16.7 characters per inch, plus proportional spacing. A 2K-byte buffer is included.



Sharp CE-150

Technology
Ball-point pen
Graphics
64 steps per inch
Color Output
4
Maximum Print Speed
11 cps
Maximum Characters Per Line
36
Character Quality
Vector plot
Interfaces
PC-1500 Pocket Computer
Paper
58-millimeter roll
Price
$230

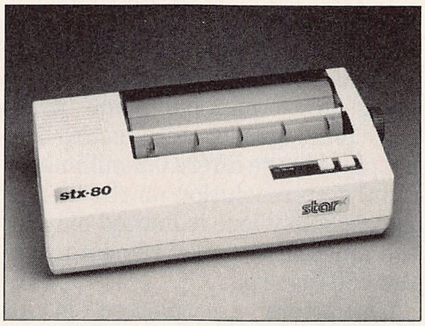
This 4-color printer/plotter/cassette interface for the Sharp 1500 Pocket Computer uses the same Alps Electric mechanism found in similar products from Radio Shack and Quasar. The CE-150 can print 4, 5, 6, 7, 9, 12, 18, or 36 characters per line at a maximum rate of 11 cps. To increase the printer's accuracy, paper slippage is restricted by tiny spikes on the paper-edge rollers. An interface for one or two cassette recorders is optional. Solid-state software modules for the PC-1500 computer include routines to draw grids, label axes, scale and plot formulas, and draw and label pie and bar charts.



Smith-Corona TP-1

Technology
Fully formed impact
Graphics
No
Color Output
No
Maximum Print Speed
12 cps
Maximum Characters Per Line
126
Character Quality
Letter quality
Interfaces
Centronics, RS-232C
Paper
Cut-sheet to 13 inches wide
Price
$895

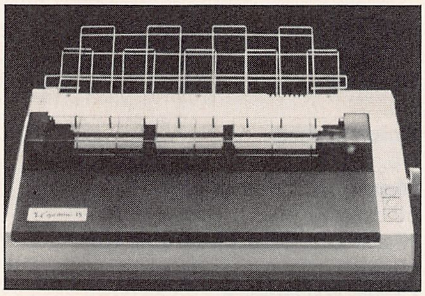
Until Transtar announced its model 130, the venerable TP-1 was the only letter-quality, less-than-$1000 printer not made by converting a typewriter. It unidirectionally prints an ASCII character set at either 10 or 12 characters per inch and offers a selection of 88-petal daisy wheels. Operators may select line spacings of 3, 4, or 6 lines per inch. Serial versions support selectable transmission rates ranging from 50 to 19,200 bits per second. A cooling fan is built in.



Star Micronics STX-80

Technology
Thermal
Graphics
64 by 64
Color Output
No
Maximum Print Speed
60 cps
Maximum Characters Per Line
80
Character Quality
5 by 9
Interfaces
Centronics
Paper
8½-inch roll
Price
$199

The STX-80 uses a 9-electrode print head and prints bidirectionally at a maximum rate of 60 cps. It uses a 5 by 9 matrix for both the ASCII 96-character set and 51 foreign characters and uses a 6 by 6 matrix for 64 block-graphics characters. Character densities of 5.5 and 11 characters per inch are available, spaced at 6 lines per inch. The STX-80 includes self-test firmware and a 256-character buffer.



Star Micronics Gemini-10/-15

Technology
Impact dot-matrix
Graphics
120 by 144
Color Output
No
Maximum Print Speed
100 cps
Maximum Characters Per Line
132/233
Character Quality
9 by 9
Interfaces
Centronics, RS-232C, 20mA
Paper
Roll, cut-sheet, fanfold up to 10/15½ inches wide
Price
$399/$649

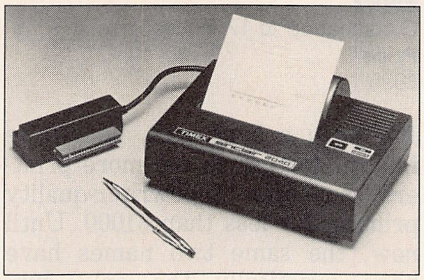
Perhaps one of the best features of the Gemini-10 and -15 is the character handling. In addition to the ASCII 96-character set, text can include 96 italic, 64 special, 32 block-graphics, 96 proportional ASCII, foreign-language, and user-defined characters. Print size can range from 5 to 17 characters per inch in both normal and emphasized density. Format capabilities include true underlining, subscripts and superscripts, backspace, vertical and horizontal tabs, margins, and line spacing programmable down to 1/144 of an inch. Both models include a standard 2.3K-byte buffer (with 4K bytes optional), self-test firmware, and a 9600-bit-per-second communications rate in the serial mode. These two printers, like the Okidata Microline printers, offer the cost-saving advantage of using spool-type typewriter ribbons.

Texas Instruments 743 KSR

Technology
Thermal
Graphics
No
Color Output
No
Maximum Print Speed
30 cps
Maximum Characters Per Line
80
Character Quality
5 by 7
Interfaces
RS-232C, 20mA
Paper
8-inch roll
Price
$995

Where TI's model 743 RO ($895) sports a front panel with control switches, this model has an uppercase ASCII keyboard. The keyboard can be replaced (at additional charge) with a full ASCII/APL key set. The 743 KSR, part of the Silent 700 data-terminal line, operates as either a portable communications terminal or (with an optional interface) as a local input/output station for TI 900 Series computers. Communications rate is selectable at 110 or 300 bits per second. TI also offers a compressed-print option for printing up to 136 characters per line.

With the ASCII keyboard, the 743 KSR prints only uppercase characters and automatically translates lowercase to uppercase. A switch on the ASCII/APL keyboard lets you send and receive either the ASCII or APL character set. A backspace-without-delete key makes it easy to handle APL's infamous overstrike characters. Readers considering subscribing to an APL-based timesharing service should look closely at this unit.

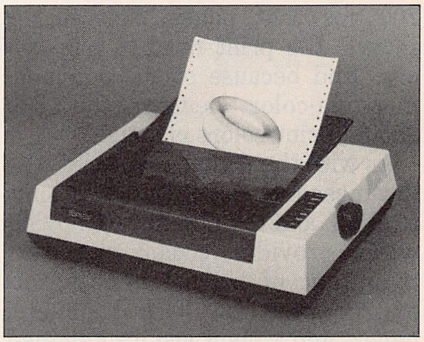


Timex TS2040

Technology
Thermal
Graphics
Unspecified
Color Output
No
Maximum Print Speed
64 cps
Maximum Characters Per Line
32
Character Quality
6 by 6
Interfaces
Timex/Sinclair
Paper
4.33-inch roll
Price
$100

Timex recently introduced this $100 32-column thermal printer for its Timex/Sinclair 1000 and 2000 personal computers.

Although the TS2040 prints only on narrow paper, it incorporates a dot-matrix print mechanism with full graphics and text capabilities and operates at a speed of 2 lines per second. The unit's two print modes allow full-screen printing with a single keystroke and program-controlled printing for custom formats. The TS2040 easily connects to any Timex computer and features simple controls enclosed in a special housing for quiet operation.



Transtar/Seikosha 315

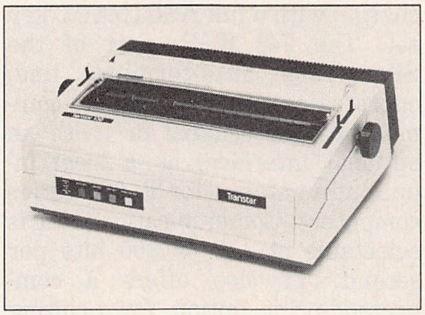
Technology
Impact dot-matrix
Graphics
80 by 80
Color Output
4 mixable primary colors
Maximum Print Speed
50 cps
Maximum Characters Per Line
106
Character Quality
7 by 8
Interfaces
Parallel, RS-232C
Paper
Cut-sheet or fanfold up to 10 inches wide
Price
$599

With the cost of personal computers falling rapidly, it's always exciting to see printers with high-end performance following suit. Scheduled to reach the stores this spring, the Transtar 315 Color Printer halves the price for online dot-addressable color printing. (The most closely comparable performance is available in Integral Data Systems' Prism printer, starting at $1295.)

The 315 uses the same type of Uni-Hammer head described in the Axiom/Seikosha GP-100 review. Actually, the 315 uses four of these heads—one for each of the four colors on the ribbon (black, magenta, yellow, and cyan). Because each color band rides continuously over its own hammer, the 315 can print up to 30 shades of 7 hues in a single 50-cps pass. As a result, the company claims that the 315 produces color graphics at a rate actually exceeding that of machines rated at 200 cps that pause, retrace, or recycle the print head to mix colors. And because of the one-hammer-to-a-color design, the 315 should print colors cleanly.

As with the Axiom GP series, the low-mass hammer includes no pins to align, and the absence of moving wires provides cooler operation than that of normal impact dot-matrix printers. The hammers, paper, and ribbon are also aligned so the ribbon moves only from spool to spool, not up and down. But for purposes of mixing colors, the 315's minimum line feed is only 1/120 of an inch. And printing is, alas, unidirectional.

The 315 can print the ASCII 96-character set (in color too) in a 7 by 8 matrix (at 10 characters per inch) or in a 5 by 8 matrix (at 13.3 characters per inch). Line spacing is program-controllable at 6 or 8 lines per inch or in units ranging from .05 inch up to 4.95 inches. Control-panel switches include line feed, forms feed, stop/pause/continue, and copy. The latter, in conjunction with an Apple II PICS interface ($99), lets you print high-resolution screen images without interrupting computer processing. You don't have to exit programs or handle disks; the copy button starts the process immediately. The company is also arranging for software drivers for such applications software as Visicorp's programs and Lotus's Executive Briefing System (for Apples) and 1-2-3 (for the IBM Personal Computer).

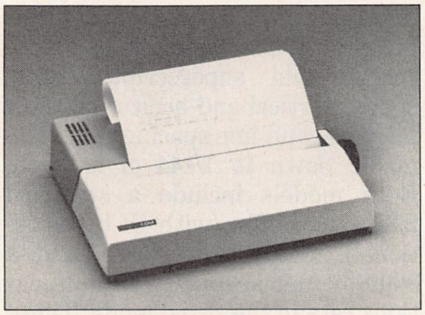


Transtar 130

Technology
Fully formed impact
Graphics
No
Color Output
No
Maximum Print Speed
16 cps
Maximum Characters Per Line
158
Character Quality
Letter quality
Interfaces
Centronics, RS-232C
Paper
Cut sheet up to 17 inches wide
Price
$895

It's been a long wait, but we're finally starting to see more printers that offer typewriter-quality printing for less than $1000. Until now, the same two names have been practically the only suppliers—Bytewriter and Smith-Corona. But now the Transtar 130 offers daisy-wheel print quality and Diablo word-processing firmware for compatibility with such application packages as Peachtext, Magic Wand, and Wordstar. And at a comparatively high speed of 16 cps, the 130 handles proportional spacing, bidirectional printing, boldface, underlining, superscripts, and subscripts.

Unique to this daisy-wheel printer is a standard feature that automatically advances cut-sheet paper to any of four positions: top of page or 1, 1½, or 2 inches down. The 130 can produce the ASCII 96-character set. Software can increment characters either 1/60 or 1/120 of an inch horizontally and 1/48 of an inch vertically. The version with the RS-232C interface (model 130S) also includes switch-selectable transmission rates from 300 to 2400 bits per second, backed by a standard 2K-byte buffer.

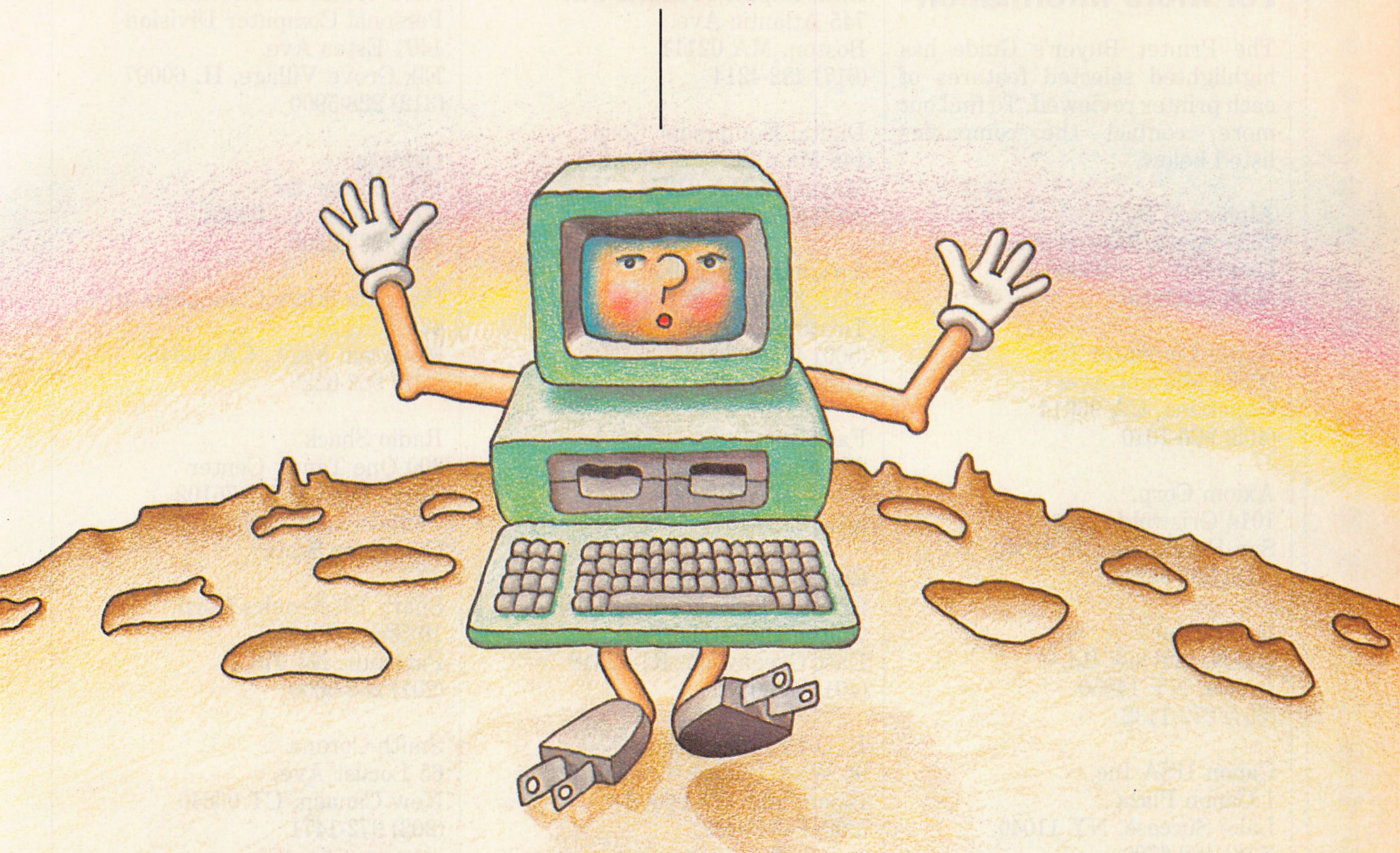


Trendcom 100G/200

Technology
Thermal
Graphics
60 by 60
Color Output
No
Maximum Print Speed
40 cps
Maximum Characters Per Line
40/80
Character Quality
5 by 7
Interfaces
Parallel TTL
Paper
Roll up to 4.4/8½ inches wide
Price
$295/$395

The model 200 differs from the 100G only by using wider paper and hence offering longer print lines. Otherwise, both models print the ASCII 96-character set bidirectionally. In the graphics mode, each dot can be individually controlled, so you can create line drawings, bar charts, or special symbols. Both models include full-line input buffers and self-test firmware. The manufacturer also offers plug-in-and-go interface modules for TRS-80, PET, Sorcerer, and Apple II printers. The PET module also lets you hook up IEEE-488 peripherals such as lab devices.

"What more can I do?"



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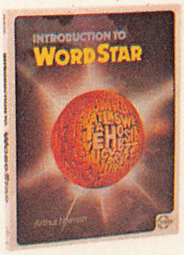

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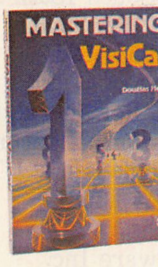

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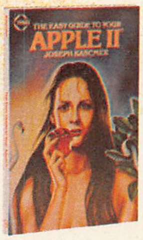

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For More Information

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2323 South Bascom Ave.
Campbell, CA 95008
(408) 559-8000

Apple Computer Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Axiom Corp.
1014 Griswold Ave.
San Fernando, CA 91340
(213) 365-9521

Bytewriter
125 Northview Rd.
Ithaca, NY 14850
(607) 272-1132

Canon USA Inc.
1 Canon Plaza
Lake Success, NY 11040
(516) 488-6700

Centronics Data Computer Corp.
1 Wall St.
Hudson, NH 03051
(603) 883-0111

C. Itoh
5301 Beethoven St.
Los Angeles, CA 90066
(213) 306-6700

Commodore Business
Machines Inc.
487 Devon Park Dr.
Wayne, PA 19087
(215) 687-9750

Computer Transceiver
Systems Inc. (CTSI)
POB 15
East 66 Midland Ave.
Paramus, NJ 07652
(800) 526-9068 or
(201) 261-6800

Data Impact Products Inc.
745 Atlantic Ave.
Boston, MA 02111
(617) 482-4214

Digital Equipment Corp.
146 Main St.
Maynard, MA 01754
(617) 897-5111

Epson America Inc.
3415 Kashiwa St.
Torrance, CA 90505
(800) 421-5426 or
(213) 539-9140

Facit Inc.
235 Main Dunstable Rd.
Nashua, NH 03061
(603) 883-4157

Gulton Industries Inc.
Graphic Instruments Division
Gulton Industrial Park
East Greenwich, RI 02818
(401) 884-6800

Hi-G Printers Corp.
96 West Dudley Town Rd.
Bloomfield, CT 06002
(203) 243-3048

Integral Data Systems Inc.
Route 13 South
Milford, NH 03055
(603) 673-9100

Irwin/Olivetti
2000 Green Rd.
Ann Arbor, MI 48105
(313) 663-3600

Mannesmann Tally
8301 South 180th St.
Kent, WA 98031
(206) 251-5524

Micro Peripherals Inc.
4426 South Century Dr.
Salt Lake City, UT 84107
(801) 263-3081

Mindware Inc.
15 Tech Circle
Natick, MA 01760
(617) 655-3388

NEC Home Electronics
Personal Computer Division
1401 Estes Ave.
Elk Grove Village, IL 60007
(312) 228-5900

Okidata
111 Gaither Dr.
Mt. Laurel, NJ 08054
(609) 235-2600

Personal Micro Computers Inc.
475 Ellis St.
Mountain View, CA 94043
(415) 962-0220

Radio Shack
300 One Tandy Center
Forth Worth, TX 76102
Contact local Radio Shack
Computer Store

Sharp Electronics Corp.
10 Sharp Plaza
Paramus, NJ 07652
(201) 265-5600

Smith-Corona
65 Locust Ave.
New Canaan, CT 06840
(203) 972-1471

Star Micronics Inc.
888 Washington St., Suite 311
Dedham, MA 02026
(617) 329-8560

Texas Instruments
POB 202146x
Dallas, TX 75220
(214) 995-2011

Timex Corp.
POB 2665
Waterbury, CT 06725
(203) 574-3331

Transtar
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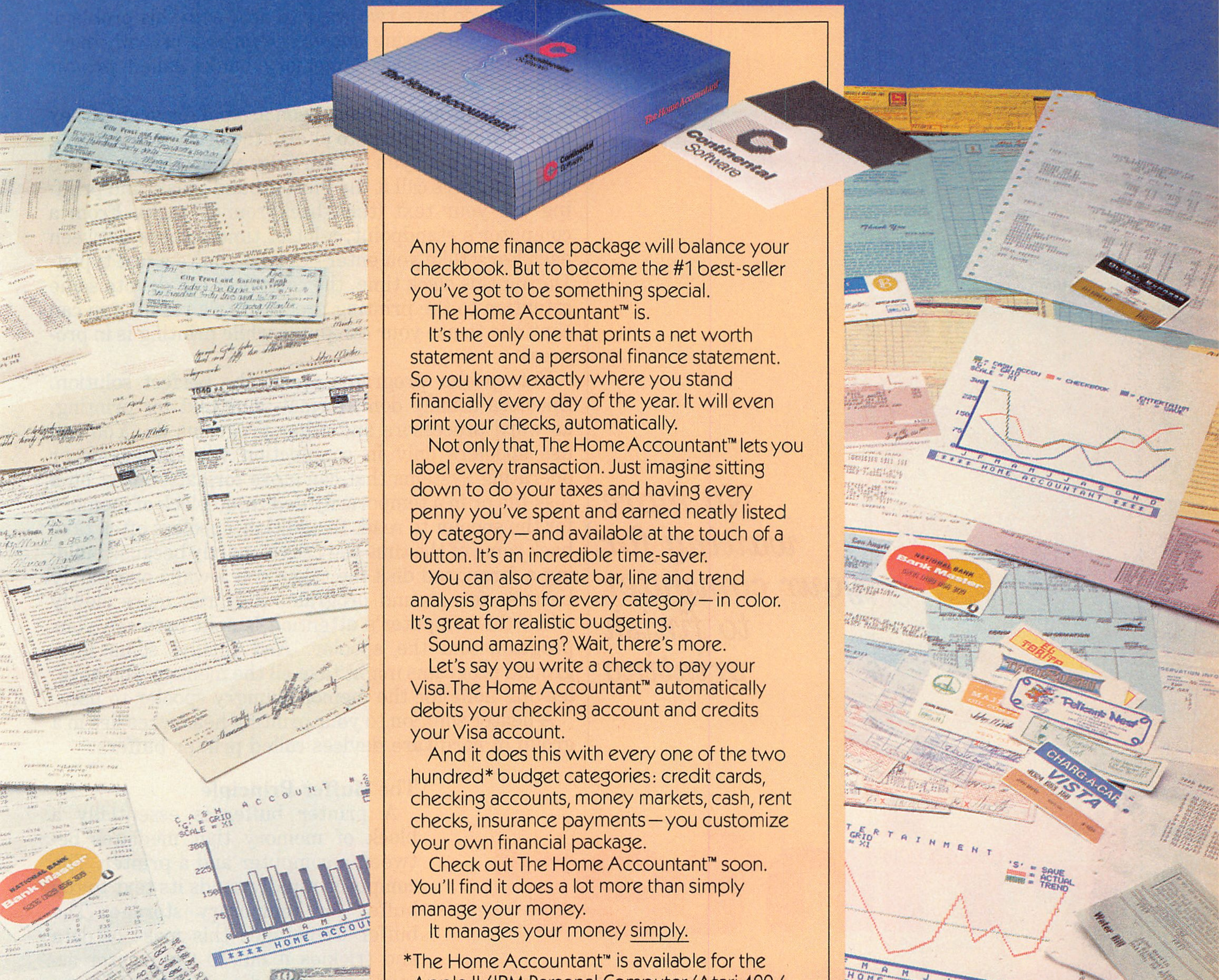

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Printer Buffers

No more waiting for your computer to finish printing

by Ivan Berger

Printers are a lot slower than computers. That simple fact is the source of much tribulation for those of us who print a lot of text. While a computer is busy sending text to the printer, we can do nothing except occasionally check to see that the printer is working properly. Last year, writing full time at home, I had to wait for more than a quarter-million words of printout, what with intermediate drafts and all. If only I could have used that time more productively!

Yet we do have two ways to deal with this problem: with software using *spooler programs* or with hardware using dedicated memory banks called *printer buffers*.

Spooler programs have been around for years. They enable your computer to alternate between processing the application you're working on at the keyboard (programmers call it the "foreground" task) and printing out your text (the "background" task). From a computer's standpoint, a lot of time elapses between each keystroke you enter—even if you're a fast typist. During this slack time, the computer can devote some attention to the printing process. As a result, you can continue to use your computer while printing is in progress.

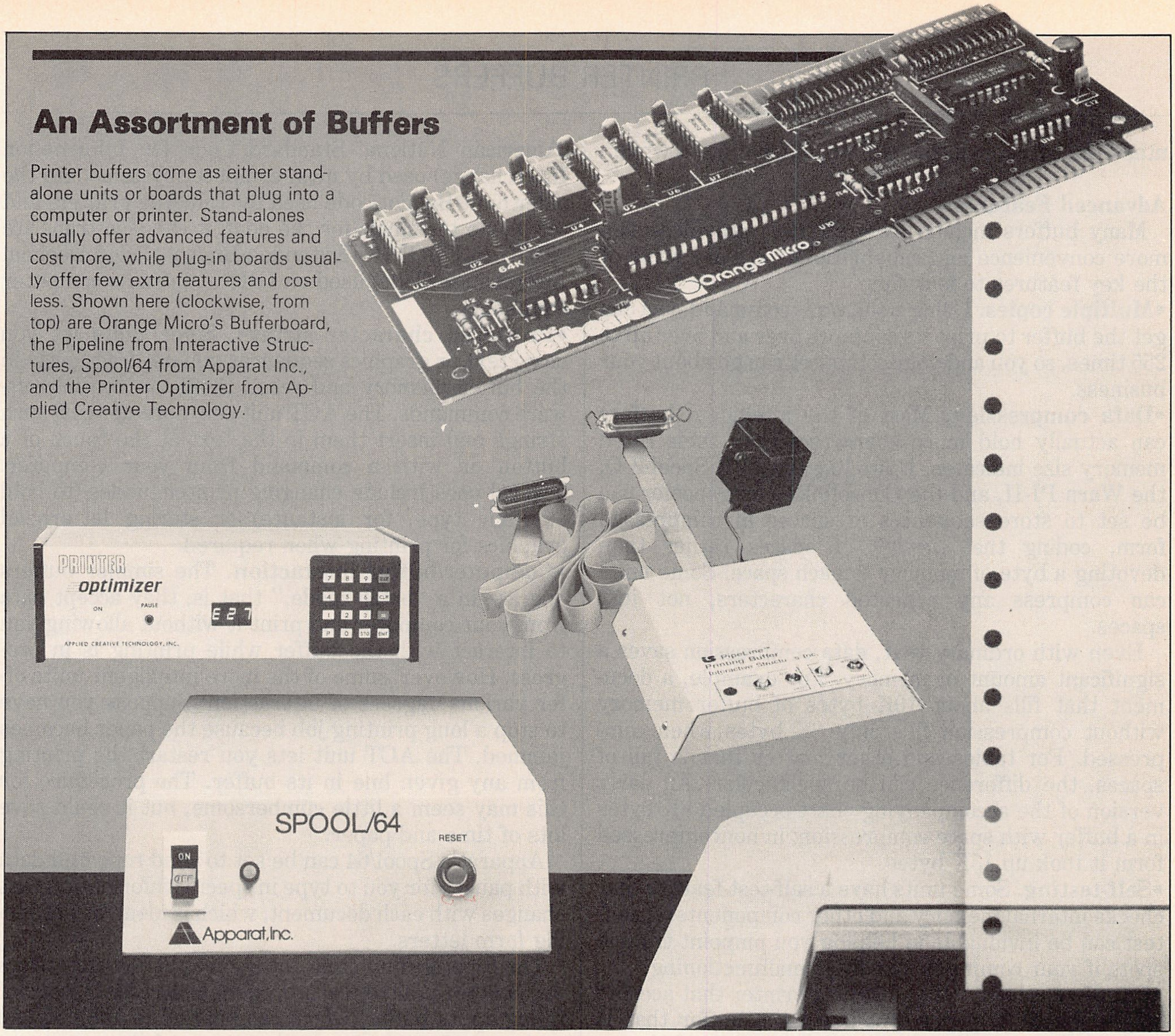
But spooler programs aren't the perfect solution. Spoolers usually don't format your text for printing, as word processors and other programs do. You can use spoolers only in conjunction with programs or operating systems that can store formatted text on a disk file or in a temporarily dedicated block of memory for the spooler to read. In addition, spoolers often take back some of the time they save—partly because building a formatted disk file takes you a while and partly because foreground programs may run more slowly when the computer's attention is split between your program and the spooler. And finally, some foreground programs might take all the memory you have, leaving none for the memory-hungry spooler to use.

A neater solution to your printing headaches lies in a group of hardware devices called printer buffers.

The Buffer Principle

A printer buffer is essentially a block of memory that mediates between a computer and a printer. The computer rapidly sends its text to the buffer for temporary storage. The buffer then takes this mass of data and trickles it out to the printer according to that device's speed limitations. Meanwhile, the computer is free to do other work—as far as it's concerned, the printing process is complete. And unlike spooler programs, these hardware devices have no effect on the computer's software.

How much memory does a buffer need? At least enough to hold your entire document, otherwise it really won't do much to free up your computer. Even a 2K-byte buffer is no help for multipage documents because each page of your document will roughly fill the buffer, and you won't regain use of your computer until the last page is printed. To hold 1024 characters of text requires 1K bytes of memory. For general printing, especially word processing, you'll need a buf-



An Assortment of Buffers

Printer buffers come as either stand-alone units or boards that plug into a computer or printer. Stand-alones usually offer advanced features and cost more, while plug-in boards usually offer few extra features and cost less. Shown here (clockwise, from top) are Orange Micro's Bufferboard, the Pipeline from Interactive Structures, Spool/64 from Apparat Inc., and the Printer Optimizer from Applied Creative Technology.

fer with at least 16K bytes of built-in storage.

Buffers as Time-Savers

Let's look at the primary purpose of printer buffers—cutting down on your slack time and your computer's idle time. Suppose I write a three-page document containing 4600 characters, including spaces and control codes. To print out a copy of that draft takes my printer 1 minute 49 seconds and ties up me and my computer for that time. But with a buffer connected to my TRS-80's parallel printer port, the computer has only a 5-second delay before it thinks it's done—and I've saved better than 95 percent of my printing time.

The slower the printer, the bigger the percentage of time saved. If my printer had taken 5 minutes to print that text, my computer's 5-second transfer time into the buffer would now be barely 1.7 percent of the total printing time instead of 4.6 percent, for a time savings of better than 98 percent. If you have a daisy-wheel printer (especially one of the new, slow, economy models or a converted typewriter) or if you're using your dot-matrix printer in a slower, letter-quality mode, you'll realize a huge time savings from a buffer.

Having all that extra memory gives you additional benefits as well. As long as your buffer has room, you can load it with a spate of documents, which it will print out in a continuous stream. This capability is especially useful when you're using a word-processing program that limits your document size to the computer's available memory, which may be as little as 16K bytes. With a 64K-byte buffer you can print about four 8-page articles (or book chapters); with 256K bytes (several buffers listed in our chart on pages 146-149 can hold that much), you can print about 16 such articles or an entire book in a matter of minutes. To be more precise, you can free up your computer in min-

A printer buffer is essentially a block of memory that mediates between a computer and a printer.

Ivan Berger is a technical editor for *Audio* magazine.

utes—the actual printing will go on for quite a while.

Advanced Features

Many buffers include software that provides even more convenience and capabilities. Here are some of the key features to look for.

- **Multiple copies.** Using a software command, you can get the buffer to print its contents over and over up to 255 times, so you and your computer can go about your business.
- **Data compression.** Most of the intelligent buffers can actually hold more characters than their rated memory size indicates. Units like the JVB Spool-Z-Q, the Warn PI-II, and the Consolink Sooperspooler can be set to store sequences of spaces in compressed form, coding the *number* of spaces rather than devoting a byte of memory to each space. Some units can compress any repeated characters, not just spaces.

Even with ordinary text, data compression saves a significant amount of memory. For example, a document that fills about 10K bytes of buffer memory without compression fills only 8K bytes when compressed. For tables and other matter that is full of spaces, the difference can be spectacular. An early version of the accompanying chart occupied 8K bytes in a buffer with space compression; in noncompressed form it took up 15K bytes.

- **Self-testing.** Some units have a self-test feature that checks internal memory and other components. A self-test can be invaluable in helping you pinpoint trouble spots if your computer system is malfunctioning.
- **Pause capability.** If you have a printer that accepts single sheets of paper, you'll want a buffer that is smart enough to stop printing each time it receives a top-of-form (new page) command. Otherwise the buffer might continue sending data to the printer while the printer waits helplessly for another sheet of paper. The Consolink Sooperspooler has what it takes; others may also have this feature, so check the specifications before you buy.
- **Forms control.** If your printer doesn't understand your computer's form-feed commands, some buffers can convert those form feeds to an equivalent number of line feeds to get to the top of the next page. The Apparat and Personal Microcomputer systems have this feature, as do some Apple boards. Some buffers (Consolink Sooperspooler, Wesper Wizard-EBI, and Practical Peripherals Microbuffer II, among others) automatically cause the printer to skip over the perforations of fanfold paper.
- **Character translation.** Occasionally the character-coding system your computer uses won't match the system your printer uses. And often your computer is unable to output one or more characters needed to take advantage of special printer functions. Character translation can solve both of these types of problems. The Data-Match Smartbuffer can translate ASCII (American National Standard Code for Information Interchange) used by most computer systems into the older 5-bit Baudot code used by Teletype printers and telephone terminals for the deaf; it can also translate ASCII to EBCDIC (Extended Binary-Coded Decimal Interchange Code) used on IBM mainframe computer equipment.
- **Prestored character strings.** Some units let you store text or graphics sequences you use frequently in the buffer memory and recall them via special software commands. The ACT unit can store up to 99 such strings and insert them in the text at the touch of a button or with a command from your computer. Typical uses include changing printer modes (to bold or italic type, for instance) or storing letterhead graphics for printing when required.
- **Computer/buffer interaction.** The simpler buffers operate in a "batch mode," that is, they accept data from your computer and print it without allowing you to interact with the buffer while printing is in progress. However, some of the more intelligent units offer various degrees of interaction. Suppose you have to stop a long printing job because the paper becomes jammed. The ACT unit lets you restart the printing from any given line in its buffer. The procedure for this may seem a little cumbersome, but it could save lots of time and paper.

Apparat's Spool/64 can be set to send repeated data with pauses for you to type in specific information that changes with each document, which is ideal for producing form letters.

The Pipeline unit from Interactive Structures offers yet another unique feature: random access. Instead of filling up its buffer (which can hold up to 128K bytes) with one document or a sequence of documents to print, you can fill it with several documents (or sequences of printer commands), label each, then print them in any desired order. The Pipeline unit can also be bypassed without losing any of its memory contents when you have to interrupt the printing of one long document to print a shorter document. You can also intersperse material from the buffer with material sent directly from the computer.

- **Status indicators.** With all these features at work, it's nice to have some indication of what the smart buffer is up to at any given moment. The Pipeline, the Freedom Slave Driver, the Practical Peripherals Microbuffer In-Line, the Quadram Microfazer, and the Western Telematic UTB-16, among others, all use LED (light-emitting diode) lamps to indicate current operating modes and conditions. The ACT Printer Optimizer and the two Consolink models have two-digit LED displays that indicate such things as the amount of memory remaining in the buffer or in use.
- **Flexible interfacing.** Suppose your printer has a serial interface but your computer has a parallel interface, making the two devices incompatible. At least a dozen buffers on our chart can perform the necessary

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                                                    (100's)
IBM    102 1/4  102 1/8  102 5/8  100 1/8  100 1/4  6701
TYM    23 3/4   23 7/8   24 1/2   23 3/4   24 1/4   530
PSA    26 5/8   26 5/8   26 3/4   25 1/4   25 1/4   334
NCR    103 3/4  104 1/2  104 7/8  101 3/8  102      1724

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conversion. Ten of them can also handle parallel-to-serial conversion. If you have both parallel and serial printers, buffers like the Consolink Sooperspooler and the Data-Match Smartbuffer can connect to both printers at once, letting you switch output from one to the other via software commands.

If you're using a slow daisy-wheel printer, you'll realize a huge time savings with a printer buffer.

A few models even let you attach multiple computers, so that one printer can handle the output of each in turn. This feature is valuable in an office where several workstations share a printer. The ACT, the two Consolink models, and the Data-Match Smartbuffer can handle two computers each, while the Intek Diplomat can be equipped to handle three. For elaborate systems, the Quadram Interfazer can handle up to 10 input or output ports with your choice of serial or parallel on each. Check the chart for other buffers that connect to multiple computers.

•**Serial communications.** When using a printer with a serial (RS-232C) interface, you're dealing with a number of variables: transmission rate, data word length, parity type, and stop bits. Make sure the buffer you're evaluating is compatible with your serial printer on all these counts. All buffers handle the two most common printer speeds, 300 and 1200 bits per second (bps). The Practical Peripherals MBS-8K and the von Leivendyke Convertabuffer handle only those two speeds; that's something of a drawback if your computer can send data at a much faster rate. The ideal combination is a split transmission rate, allowing your computer to send data as fast as 19,200 bps while the buffer sends data to the printer at a slower rate.

Many serial-port models can also convert between the handshaking protocols that computers and printers use to tell the computer when to send data to a waiting printer and when to withhold it while the printer is busy. If your computer, for example, uses the XON/XOFF protocol while your printer requires ETX/ACK commands, several models can convert between the two types. It is possible to print despite a handshake mismatch but only at less than the printer's maximum speed. Thus, it pays to be able to correct such a mismatch.

Companies to Contact for Further Information

Apparat Inc.
4401 South Tamarac Parkway
Denver, CO 80237
(303) 741-1778

Applied Creative Technology Inc.
2723 Ave. E East, Suite 717
Arlington, TX 76011
(800) 433-5373 or
(817) 261-6906

Consolink Corporation
1840 Industrial Circle
Longmont, CO 80501
(800) 525-6705 or
(303) 651-2014

Data-Match
3810 Oakcliff Industrial Court
Doraville, GA 30340
(404) 441-0408

Freedom Micro-Systems
Star Route 5
Wytheville, VA 24382
(703) 228-5800

Intek
780 Charcot Ave.
San Jose, CA 95131
(408) 946-9041

Interactive Structures
146 Montgomery Ave.
Bala Cynwyd, PA 19004
(215) 667-1713

JVB Electronics
1601 Fulton Ave., Suite 1
Sacramento, CA 95825
(916) 483-0709

Orange Micro Inc.
4501 East Eisenhower Circle
Anaheim, CA 92807
(714) 779-2772

Personal Microcomputers
475 Ellis St.
Mountain View, CA 94043
(415) 962-0220

Practical Peripherals
31245 La Baya Dr.
Westlake Village, CA 91362
(213) 991-8200

Quadram Corporation
4357 Park Dr.
Norcross, GA 30093
(404) 923-6666

Vertical Data Systems
1215 Meyerside Dr., Unit 2
Mississauga, Ontario
Canada L5T 1H3
(416) 671-1752

Von Leivendyke Enterprises
Silvermine Ave.
Norwalk, CT 06850
(203) 846-4973

Reith Walcott Engineering
8807 Shadowood Dr.
Everett, WA 98204
(206) 337-4792

Warn Electronics
POB 526
315 Park Ave.
Knightdale, NC 27545
(919) 266-9411

Wesper Microsystems
14321 New Myford Rd.
Tustin, CA 92680
(800) 854-8737 or
(714) 730-6250

Western Telematic Inc.
2435 South Anne St.
Santa Ana, CA 92704
(800) 854-7226 or
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With a split transmission rate, the computer sends data at a faster rate while the buffer sends data to the printer at a slower rate.

•**Special-purpose interfaces.** The Intek Diplomat can be set up for printers that use current-loop interfaces (mostly old Teletypes, though the current loop is still used where electrical noise is a problem). Warn's PI-II buffer is designed specifically for use with daisy-wheel printers (though it can be used with dot-matrix models as well), and Intek's Diplomat has similar features available. The Databin unit from Vertical Data Systems is a buffered interface for electronic typewriters.

Stand-Alones vs. Boards

Of the buffers listed in our chart, almost half are designed to stand alone between a computer and a printer. The others are designed to fit into or onto a specific type of computer or printer and usually to take their operating power from their "host." Of the latter type, most computer boards fit the Apple II (and presumably the IIe and sometimes the III) or the IBM Personal Computer; most printer boards fit the Epson MX series, reflecting the popularity of that equipment. (In addition, several multipurpose IBM Personal Computer memory boards, not covered here, come with spooler programs that let the boards act like buffers.)

The plug-in boards tend to be simple buffers with few other features and with accordingly lower prices ($139 to $650 vs. $199 to $1875 for stand-alones). Plug-in boards occupy no desk space (although the computer boards do occupy computer circuit-board slots you might want to use for other purposes) and usually require few or no special commands.

Plug-in buffers lack many of the intelligent features described earlier. However, in working with one of these buffers (Practical Peripherals Microbuffer MBP-16K for the Epson MX-80), I was bothered by the lack of only one such feature: a buffer clear, or reset, button. The need for a clear button arises often—when the paper jams or you notice an error that is repeated throughout your text, for example.

Pausing in the middle of printout was easy with the MBP. I just pressed the printer's online/offline switch and held it until the printer reached the end of the line and stopped. But aborting a printout altogether required emptying the buffer, and the only way to do that was to go offline, press the form-feed button to get the paper to the top-of-form position, then switch the printer off and on again.

The von Leivendyke Convertabuffer and the Quadram Microfazer, which mount outside their hosts, have reset buttons to prevent this problem. And some computer boards can be reset from the computer's keyboard, either by software commands or with the computer's reset key. In the latter case, you can usually command the buffer to ignore the reset key in case you need to use it for other purposes while printing is in progress.

Stand-alone buffers are far more versatile than boards. Stand-alones can be used with a greater variety of equipment because they contain standard interfaces. Furthermore, they usually have far more features, both because they're more likely to have their own microprocessors and because they have accessible panels to hold controls and status displays.

Some stand-alones have built-in power supplies. Others have separate power supplies, built into large transformer/AC plugs like those sold for many tape recorders. The models with separate power supplies often take up less space on the desk, but it may be harder to find room in your outlet strip for the bulky transformer/AC plug. The champion miser of desk space is the Consolink Microspooler, whose vertical format lets it fit into a mere 2.6 by 9.3 inches of desk space, despite its built-in memory display and power supply.

The Ultimate Buffer

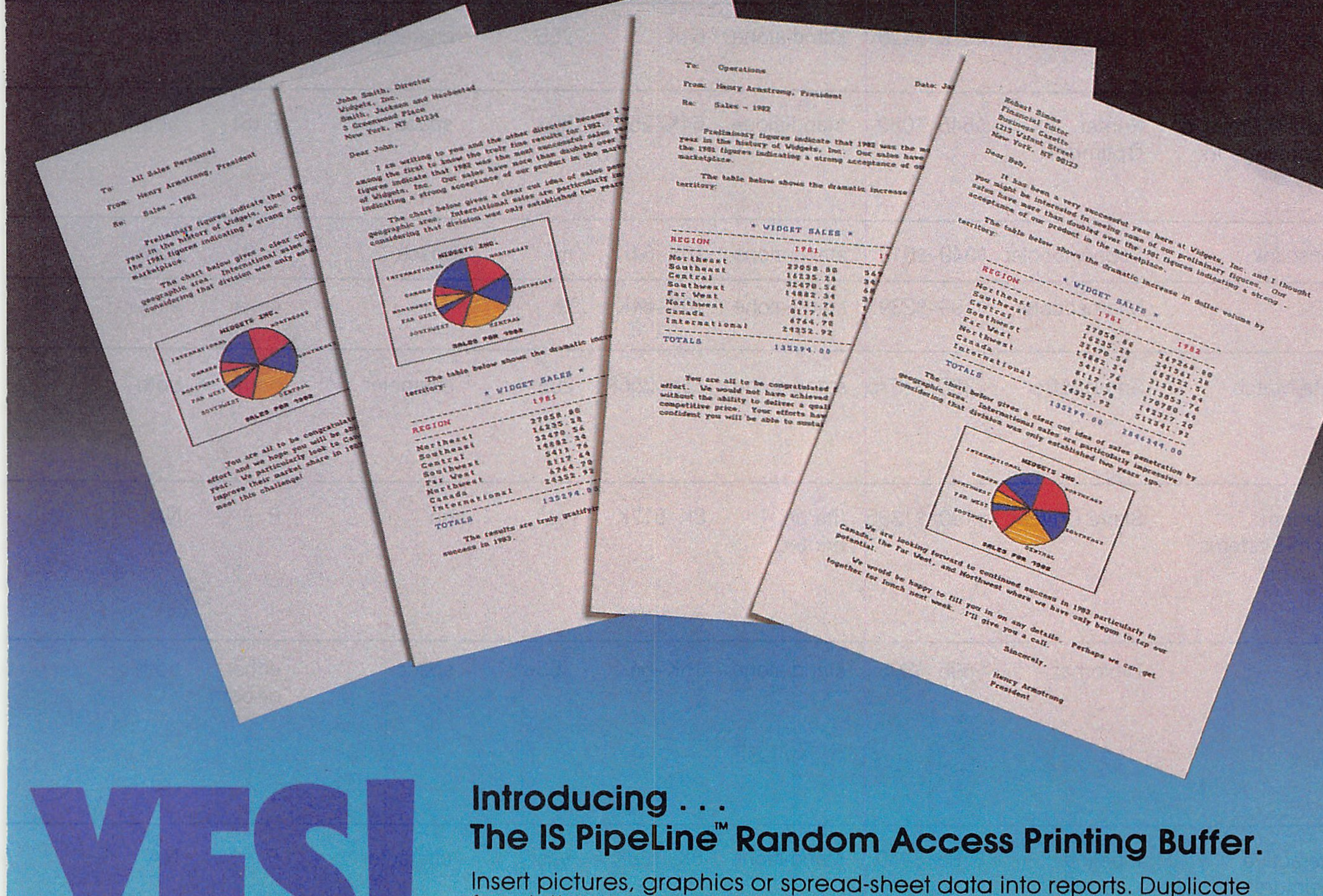
Looking at the features of the deluxe units listed in our chart, what more could you want? Well, lower prices, for one thing. With microprocessor and memory prices continuing to fall, you may not have too long to wait. And you can expect a vast number of brand-new features to appear as well.

The newest generation of dot-matrix printers can be programmed to produce any type font you wish, from Old English-style to the typeface you are reading now. The hitch is that your computer must send graphics bit patterns rather than ASCII characters to the printer. That's a major stumbling block for two reasons. First, someone must define the desired typeface in terms of dot patterns, a tedious and challenging process. Second, these customized patterns must be stored in random-access memory, which takes up a lot of space. Sounds like a good job for the ultimate buffer.

In fact, buffers of the future will really be sophisticated, fully programmable computers. They will be able to accept multiple typefaces from the host computer and produce elegant results on dot-addressable printers. They'll be able to work with a variety of printers and computers because they'll be so fully programmable.

Don't expect these capabilities immediately—both the software and hardware must be developed. Meanwhile, today's printer buffers are well worth their cost in terms of the time they'll save you. □

RANDOM ACCESS IN A PRINTING BUFFER?



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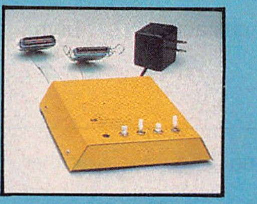

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The IS Pipeline™ Random Access Printing Buffer is patent pending.

A Comparison of Printer Buffers

The products listed below offer an assortment of features that are explained in the text. For company addresses, see page 142.

Company	Model	Price	Type	Storage (bytes)	Multiple Copies	Data Compression	Interfaces (Parallel/Series) I/O	Interfaces (Parallel/Series) Conversion
Apparat Inc.	Spool/64	$319-$428	stand-alone	64K	255	character	P (S)	both
Applied Creative Technology Inc.	Printer Optimizer	$545-1080	stand-alone	64K-256K	99	space	P (S)	both
Consolink	Sooperspooler	$349-$613	stand-alone	16K-64K	no	space	P (S)	both
	Microspooler	$199-$339	stand-alone	16K-64K	99	no	either	either
Data-Match	Smartbuffer	$335-$1875	stand-alone	16K-256K	255	character	both	both
Freedom Micro-Systems	Slave Driver	$190-$1395	fits on printer	8K-512K	yes*	no	P	NA
Intek	Diplomat	$595-$895	stand-alone	16K-64K	255	space	either or both	both
Interactive Structures	Pipeline	$195-$440	stand-alone	8K-128K	yes	character	P	NA
JVB Electronics	Spool-Z-Q	$246-$336	stand-alone	32K-128K	yes*	space	P	no
Orange Micro	Bufferboard	$175-$259	Apple II and III board	16K-64K	no	no	P	NA
Personal Microcomputers	Printermaid*	$349	stand-alone	64K	255	character	both	both
Practical Peripherals	Microbuffer: II	$259-$299	Apple board	16K-32K	no	no	either	no

Notes:
* – see Remarks column
TK – to come in future version of buffer
(x) – optional

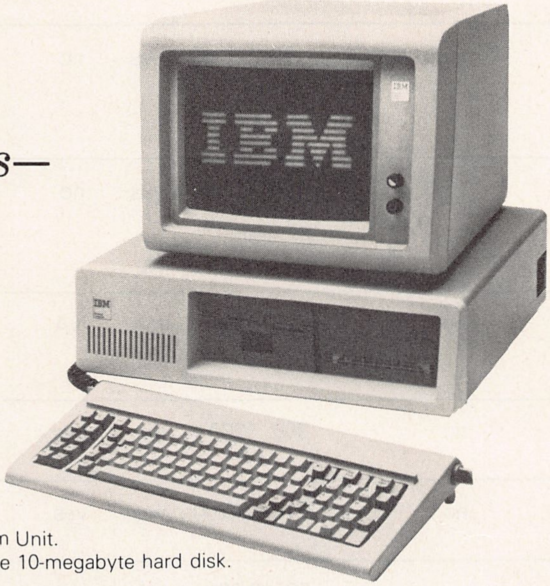
Multiple Inputs	Self-Test	Form-Feed or Pause Commands	Form-Feed Conversion	Display	Transmission Rate (bps)	Split bps	Protocol Conversion	Remarks
2	yes	yes	no	no	110-19,200	yes	TK	fill-in mode; user-programmable Z80
2	yes	no	yes	free memory, error	110-9600	yes	yes	keypad for up to 99 stored functions, including ASCII strings
2	yes	yes	yes	free memory	110-19,200	yes	no	skips perforations
2	yes	yes	no	free memory, copy number	50-19,200	yes	yes	compact
2	yes	yes	no	LEDs: ready, stopped, form feed	150-19,200	yes	yes	software-steerable port select; code conversion includes ASCII/Baudot
no	no	no	no	LED: full	NA	NA	NA	powered by printer or AC adapter; fits parallel interface; *push button to make 1 copy
3	yes	no	yes	LEDs: ready, error	50-19,200	no	yes	takes 4 devices, 1-3 in or out; signal tones; can directly drive 13-bit Qume, Diablo for faster throughput
no	auto	responds to paper-out status/offline	no	3-way LED	NA	NA	NA	random access; can interrupt and bypass; external power supply; special version for PKASO Apple graphics board
no	yes	no	no	no	NA	NA	NA	*one copy per push; cables included
NA	yes	no	no	no	NA	NA	NA	docks to printer interface board; versions for Grappler+ and Epson
no	yes	yes	yes	LEDs: ready, pause	50-19,200	no	yes	*available in mid-1983; can use any ASCII characters as commands
no	yes	yes	no	no	300, 1200	NA	no	special graphics features; $119 Snapshot screen-dump attachment available

Company	Model	Price	Type	Storage (bytes)	Multiple Copies	Data Compression	Interfaces (Parallel/Series)	
							I/O	Conversion
Practical Peripherals	MBP-16K	$159	Epson board	16K	no	no	P	no
	MBS-8K	$159	Epson board	8K	no	no	S	no
	In-Line	$299–$349	stand-alone	32K–256K	255	no	either	no
Quadram	Microfazer	$169–$369	printer add-on	8K–64K	yes*	no	both	either
	Interfazer	$295–$1535	stand-alone	2K–128K	no	no	both	both
Vertical Data Systems	Databin	$595	special	64K	9	no	S	NA
Von Leivendyke Enterprises	Convertabuffer	$229–$299	fits on IBM PC	8K–32K	no	no	P in	P→S
Reith Walcott Engineering	Intelligent Data Buffer	$175–$325	stand-alone	16K–64K	no	space	S (P)*	both
Warn Electronics	Intelligent Printer Interface, PI-II	$525–$650 $200–$225	board bare board	16K–60K	255	space	both	NA
Wesper	Wizard-EBI	$139–$280	Epson board	8K–64K	no	no	P	NA
	Wizard-SOB	$249–$289	Apple II board	16K–32K	no	no	S	NA
	Wizard-BPO	$179–$219	Apple II board	16K–32K	no	no	P	NA
	Wizard-Spooler	$289–$436	IBM PC board	16K–64K	no	no	P	NA
	Wizard-S/P	$349–$496	IBM PC board	16K–64K	no	no	both	NA
Western Telematic	Printer Port Buffer PPB-4	$395	stand-alone	4K	no	no	S	NA
	Universal Terminal Buffer UTB-16	$495	stand-alone	16K	no	no	S	NA

Multiple Inputs	Self-Test	Form-Feed or Pause Commands	Form-Feed Conversion	Display	Transmission Rate (bps)	Split bps	Protocol Conversion	Remarks
no	no	no	no	no	NA	NA	NA	optional buffer-clear button; serial version fits parallel Epson
no	no	no	no	no	300-19,200	NA	no	
2	yes	no	no	LEDs	75-19,200	yes	yes	serial version can input or output from either port
no	yes	no	no	LED: error	150-19,200	yes	no	separate power supply ($20); *manual repeat by button after print
8	yes	no	no	LED: error	150-19,200	yes	no	multidevice controller; up to 10 input or output ports ($65 each)
no	yes	TK	yes	no	110-9600	NA	NA	2-way interface for Olivetti 121 electronic typewriter
no	no	no	no	no	300, 1200	no	yes	serial out only
2	yes	no	no	no	110-19,200	yes	yes	*optional IEEE-488, RS-422 input/output
2	yes	NA	no	no	50-19,200	NA	Xon or custom	direct interface for daisy-wheel printers; control of platen, carriage, wheel; keyboard input for local or terminal use; case optional
no	no	no	no	no	NA	NA	NA	serial version coming
no	no	no	no	no	50-9600	NA	NA	graphics features
no	no	no	no	no	NA	NA	NA	graphics features
no	yes	no	no	no	NA	NA	NA	
no	yes	no	no	no	50-9600	NA	NA	selectable serial or parallel output
no	no	no	no	no	150-9600	yes	no	
no	no	no	N	LEDs: ready, transmitting, full	75-9600	yes	yes	16K-byte unidirectional or 8K-byte bidirectional

IBM's Personal Computer XT

Everybody is trying to outdo IBM these days—even IBM



IBM's Personal Computer XT—
the new features are in the System Unit.
The most significant addition is the 10-megabyte hard disk.

by George Stewart

Less than 18 months after introducing its Personal Computer, IBM has unveiled an extended model that overcomes most of the limitations of the standard unit. The Personal Computer XT includes a 10-megabyte hard disk, a 360K-byte floppy-disk drive, and 128K bytes of random-access memory. Three option slots have been added internally, and a separate 10-megabyte Expansion Unit is also available for use with the XT or the standard Personal Computer. IBM has put an aggressively low $4995 price on the basic XT and has also decreased system prices for the standard Personal Computer by about 15 percent. Both moves have other manufacturers scurrying to cut their own prices.

Hard-disk storage is essential for many business applications, but until now IBM owners have had to add non-IBM hard-disk units to their systems and modify the software to support them. This mix-and-match approach can lead to problems of software incompatibility and unclear maintenance responsibilities. With the availability of IBM's own hard disk, both the XT and the standard IBM Personal Computer will be very attractive in the business market.

Along the same lines, IBM now offers its own high-resolution color monitor for both models of the Personal Computer. IBM had offered only a monochrome monitor, and users needing a color display had to select from those offered by a half dozen or more manufacturers. IBM's 12½-inch display generates 16 colors on a black-mask screen, providing exceptional contrast and color definition.

In short, IBM now markets almost all the pieces for a complete business system: computer, hard disk, graphics printer, and monochrome or color display. Still missing are an IBM modem, light pen, high-speed printer, and letter-quality printer. There's no reason to doubt that IBM will eventually offer all of these peripherals. Equally important for present and prospective Personal Computer owners is IBM's introduction

At a Glance

Name: IBM Personal Computer XT

Manufacturer
IBM Corporation
System Products Division
Entry Systems
POB 1328
Boca Raton, FL 33432

Uses
Personal computing, word processing, and general business applications

Standard Features
System unit: 8088 microprocessor, 128K bytes of random-access memory (RAM), 40K bytes of read-only memory (ROM) containing BASIC language interpreter and system software, 10-megabyte hard disk, double-sided floppy-disk drive, asynchronous communications adapter, speaker, and eight system expansion slots (five are unused in the basic unit); detachable keyboard: 83 keys including 10 function keys, numeric/cursor-control keypad, buffered input for key-ahead while computer is busy, automatic repeating on all noncontrol keys, print-screen key, insert and delete keys for screen editor

Base List Price
$4995

Typical System Price
$6514 including Graphics Printer, Color Display, and display/printer adapter

Documentation
Operations guide and BASIC language reference manual

Options and Accessories
Monochrome or Color Display, Graphics Printer, Expansion Unit containing one or two 10-megabyte hard-disk drives, RAM expansion up to 640K bytes total

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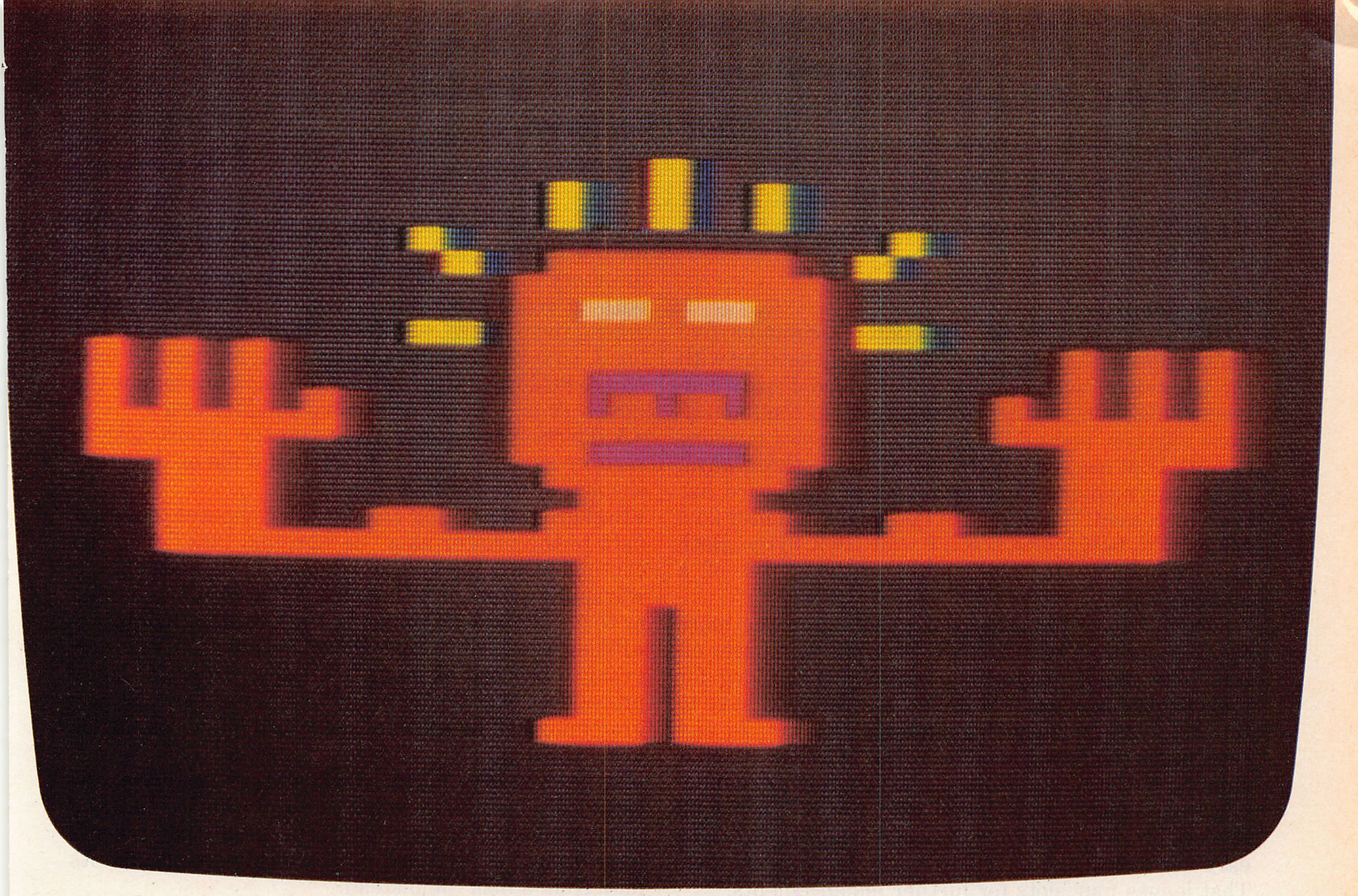
George Stewart is senior technical editor of *Popular Computing*.



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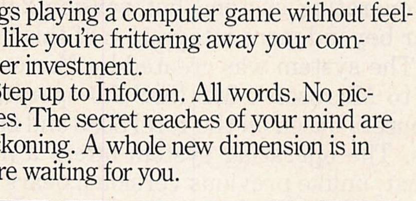

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of a powerful new version of its disk operating system (PC-DOS).

Expandability

IBM's standard Personal Computer contains five built-in option slots, but these are quickly used up with the addition of such essentials as a video-display controller, disk controller, printer interface, communications adapter, and additional random-access memory (RAM). IBM has remedied this problem in three ways. First, the memory capacity of the motherboard has been increased. The standard Personal Computer now comes with 64K bytes, the XT with 128K bytes. Both are expandable to 256K bytes without use of a memory card.

Second, the XT motherboard contains three more option slots than the standard Personal Computer offers. The regular expansion boards are too long for two of these new slots, however, so users will have to fill them with smaller single-function boards. At any rate, users can now add all essential functions without running out of option slots. An asynchronous communications adapter is included with the XT, using up one option slot. The hard-disk and floppy-disk drives each use a slot, and a display controller uses another. That leaves four slots for further enhancements.

Third, IBM now offers an Expansion Unit for both the standard Personal Computer and the XT. One 10-megabyte hard disk is built into the Expansion Unit, and a second may be added. The Expansion Unit includes eight option slots, two of which are used by the hard disk and System Unit connector.

To accommodate all these enhancements, IBM has beefed up the power supply to a capacity of 130 watts; the standard Personal Computer is limited to 63.5 watts. The Expansion Unit has its own 130-watt power supply as well.

PC-DOS Version 2.0

Supporting the hard-disk system required some changes to the operating system, but version 2.0 of PC-DOS goes far beyond mere integration of this new storage device. The system was created by Microsoft and is identical to Microsoft's MS-DOS 2.0 operating system for computers based on the Intel 8088 and 8086 microprocessors. The operating system offers a new user interface that, unlike previous versions, bears little resemblance to CP/M. In fact, it has many of the features of Xenix, Microsoft's powerful multiuser operating system for computers based on the Motorola 68000 microprocessor.

PC-DOS 2.0 occupies 20K bytes of memory—12K bytes more than version 1.1. Programs written to 1.0 or 1.1 standards will run under the new version. Following guidelines set forth by Microsoft, a programmer can create source code that is compatible with both PC-DOS 2.0 and Xenix. Other highlights of PC-DOS 2.0 include the following:

- Tree-structured directories are used to organize files on the large-capacity hard disk. The old CP/M-type directory lists all files with equal precedence and without recognizing any relationships that may exist among them. A tree-structured directory, on the other hand, lets you organize files by type, function, or user name. PC-DOS 2.0 provides commands to examine the directory and create or remove subdirectories.
- A file-recovery utility gives you the opportunity to recover as much data as possible if a file or directory should become garbled.
- Background printing enables the computer to output data to the printer as a "background task." You can continue using the system while printing goes on.
- Graphics-screen printing means that graphics as well as text may now be copied to the Graphics Printer.
- Piping is a facility that allows output from one program to be used as input to another program. Many procedures that would otherwise require special programming can be accomplished with a few commands using this feature.
- Redirected input/output makes programs more versatile because various input or output devices may be interchanged. For example, a program that accepts data from the keyboard can be easily set to take its data from a disk file instead.
- Several powerful new BASIC features are a part of the Disk BASIC and Advanced BASIC that come with version 2.0. These include support for the tree-structured directory, double-precision transcendental functions (SIN, COS, LOG, and so on), and graphics and music enhancements.

Other Software

IBM has adopted a wide assortment of newly customized applications programs from Peachtree Software. All of these require the use of DOS 2.0, but they will run on the standard PC or the XT.

Peachtext is a word processor with some unusually powerful features. For example, you can pull together information from several documents by using logical commands such as IF *condition is true* THEN *get paragraph A*. Also, text files can be larger than the amount of RAM available because individual pages are automatically stored to and retrieved from disk as needed.

Additional new Peachtree programs include accounts payable, accounts receivable, general ledger, inventory control, and payroll.

Turning the Tables

IBM look-alike computers have been coming along at the rate of one a month lately. Most claim at least one advantage over the Personal Computer, be it portability, more standard RAM, more free option slots, voice input, better graphics resolution, or lower price. IBM's latest move shows how easily the friendly giant can turn the tables. Or should we say turn the screw?□

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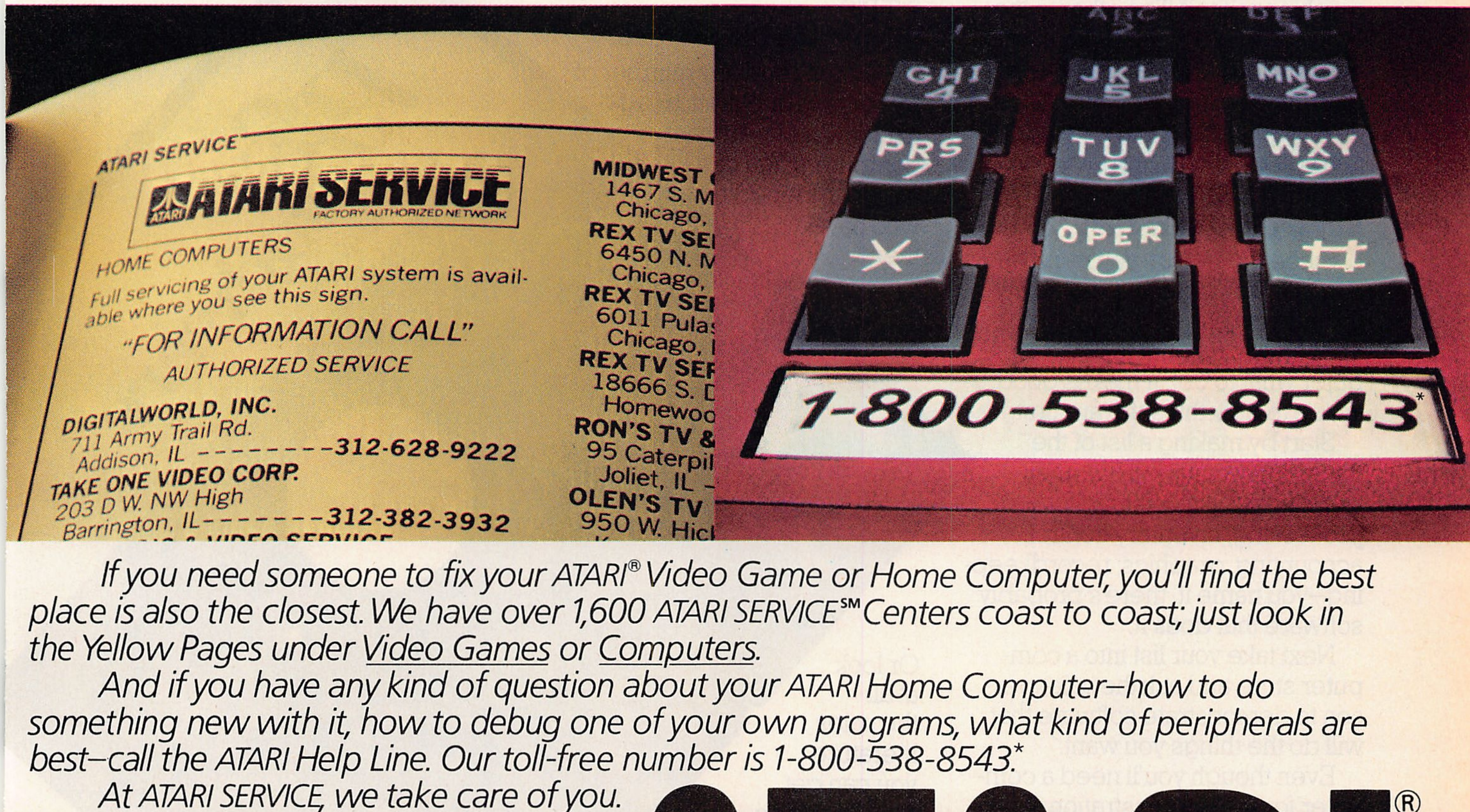

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One part is the "hardware," the machinery itself. The other is the "software," which tells a computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything. And vice versa. You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember it's the software that tells the computer what to do), it makes good sense to pick the software first.

Start by making a list of the things you want the computer to do. Possibilities include word processing, inventory control, accounting, graphics, recordkeeping—you name it, there's probably software that does it.

Next take your list into a computer store and ask the salesperson to demonstrate software that will do the things you want.

Even though you'll need a computer for the demonstration, keep in mind the computer is just a vehicle. The software is the driver. Once you've decided on software, picking the rest of the computer system will be that much easier.

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Some people will tell you that software has to be complicated to be powerful. Nothing could be further from the truth.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you want to do without getting in the way.

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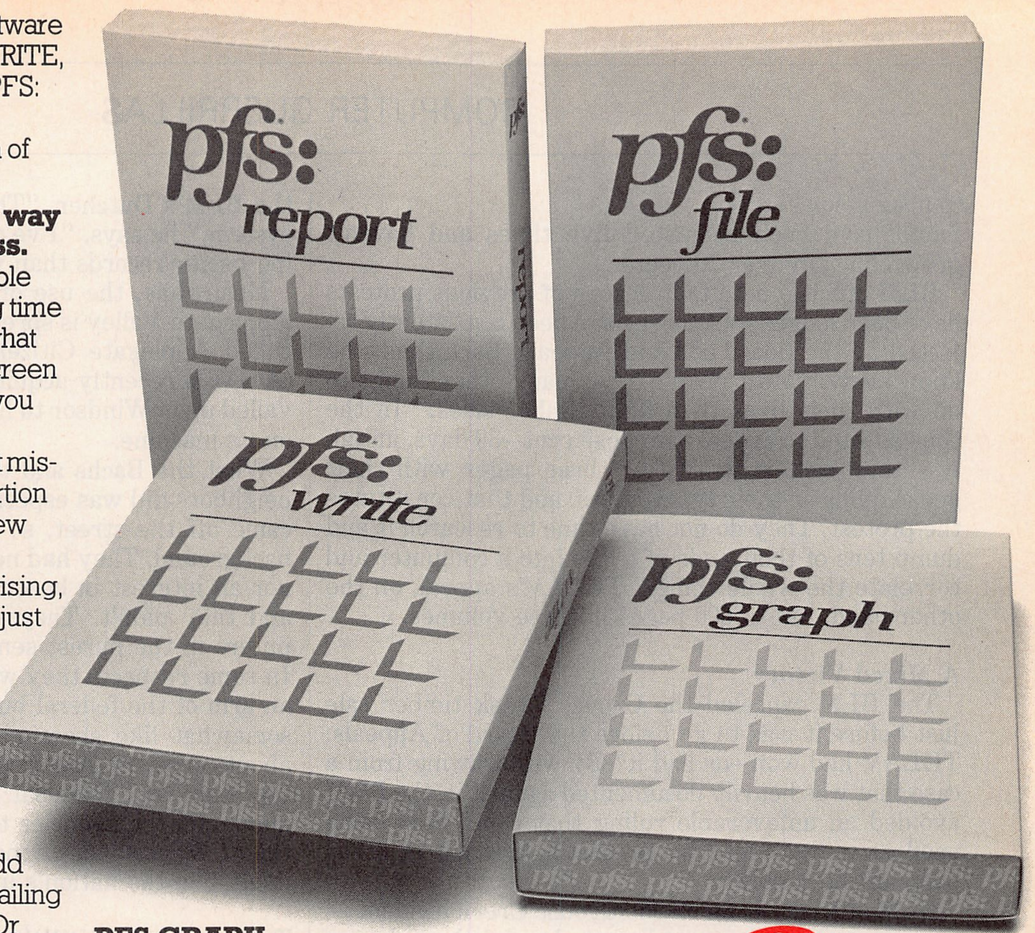

Currently there are four software packages in the family: PFS:WRITE, PFS:FILE, PFS:REPORT and PFS:GRAPH, with more on the way. Here's a little more about each of them.

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PFS:WRITE is ideal for people who want to make their writing time more productive. It displays what you write on your computer screen so you can make revisions as you compose.

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WRITE also works with most popular software programs, including the PFS Family of Software.

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FILE is basically a paper filing system without the paper. So you can record, file, retrieve and review information in a fraction of the time it takes with a conventional filing system.

With FILE, you arrange your information on a "form" you design yourself. And when you need to track something down, FILE sorts through your records electronically. It lets you retrieve information in a variety of ways so you can be as selective as you want.

PFS:REPORT. The simplest way to sum it all up.

REPORT is a powerful analysis tool that works with FILE.

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PFS:GRAPH. The simplest way to spot trends.

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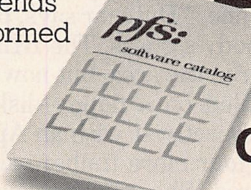

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CONTINUED FROM PAGE 94

found have been replanted five times and haven't grown back in over 20 years.

BLM officials note that dozens of previous protests have been lodged, but these have been consistently rejected by the Board of Land Appeals. Bach thinks he knows why: "Most people have many other things to do with their lives than fight timber sales." In the time allotted to appeal a proposed cut—30 days, initially—"they can write two or three pages with their goose quills or their typewriters, and that constitutes the protest. They do not have time to research it and dump tens of thousands of bytes into a computer and correlate the whole thing." TELAV's appeal, on the other hand, ran to 600 pages in three volumes.

A Mixed Victory

The BLM canceled the Grouse Creek timber sale just before it was to go before the Board of Appeals. TELAV had won—or had it? By withdrawing from a case that was heavily documented against it, the BLM avoided an unfavorable ruling that could have been used as a precedent by protesting groups in other parts of the country.

BLM officials shrug off the Grouse Creek incident as "an oversight on our part," caused mainly by a change in state regulations that tightened up the definition of commercial timberland. "It was like changing the rules in the third quarter of a football game," explains John Dutcher, the Little Applegate Valley Area manager for the BLM. "Based on that, we withdrew," he says, somewhat unnecessarily adding that "it was kind of awkward."

But TELAV got its hands on the ball again when the BLM put the 237-acre Lick Gulch timber sale out for bid; the Bachs cranked out another 600-page protest, and the proposed sale is still on appeal. "We're all hanging our hats on that one," Dutcher says, but when it will be decided is anybody's guess. The BLM is still trying to sell more timber in the area, but now that the basic appeal format is filed on a floppy disk, Jenny Windsor, another TELAV activist with an Apple, has cranked out protests on four more timber sales totaling more than 2,000 acres. She simply calls up the statement of reasons from the word-processing file, changes the arguments to fit the current sale, prints it out, and sends it off.

The arguments have settled into a typical standoff: TELAV says the valley is too marginal to produce timber, but the BLM says it's good enough.

TELAV has since incorporated as a nonprofit organization. Using a simple database program called Visifile, one of Visicorp's series of packaged programs for microcomputers, the group has computerized all of the BLM's reforestation records in the area, thus putting it on more equal footing with the federal agency in knowing exactly what's happening to the forest lands. This effort has also drawn grudging admiration from the BLM's Dutcher. "They do have a neat computer system," he says. "I've often kidded them about having better records than we do."

Meanwhile, the use of computers to protect Little Applegate Valley is spreading. Another protest group called Applegate Citizens Opposed to Toxic Sprays (ACOTS) recently acquired an Apple II and has prevailed upon Windsor to help the group get up to speed on its machine.

What the Bachs and their Little Applegate Valley neighbors did was especially impressive because they came off the street, so to speak, with no computer background. They had neither computer-science skills nor an interest in becoming computer programmers, and they didn't. They were able to use their computers in the purest sense: as general-purpose tools. In some respects they were lucky; coming up against an arm of the federal bureaucracy like the BLM was somewhat like shooting fish in a barrel. But what about corporate America and the industries that have the legal and financial clout to stand up to, if not dominate, the agencies that are supposed to regulate them? What about an industry that's an institution in itself, like the nation's utilities?

Taking On the Utilities

The Environmental Defense Fund (EDF) is one of a number of environmental and consumer groups that have for years been jousting with utilities over soaring gas and electric rates and questioning the need for new power plants, particularly nuclear ones. EDF's goal is to ease the pressure on the nation's air, water, and energy resources by arguing for less exploitation and more conservation. Its focuses are water quality, toxic chemicals, lead in gasoline, and energy use. Its weapons are economic analysis and legal action.

Following the oil crunch of the mid-1970s and the subsequent skyrocketing oil prices, EDF began to lose its record of frequent intervention in utility-rate cases and found itself increasingly unable to stand up to the utilities.

The turning point came in a 1977 rate hearing when Zack Willey, EDF's chief scientist, tried valiantly to take on one utility company. Armed with only a pocket calculator, he sat in vain punching in 64 variations of a single equation, no match for the utility's foot-thick computer printout. His failure was embarrassing. Vowing never to do that again and having grown tired of getting sand kicked in his face by the utilities, Willey hired Dan Kirshner, a young graduate of the University of California at Santa Cruz with degrees in economics and physics, to build up EDF's computer muscle. A self-taught programmer who looks every bit as young as he is (he's 28), Kirshner took six months to computerize Willey's single-equation model. The result, written in FORTRAN, is ELFIN (for electric/finance), a model that allows EDF or anyone else who uses it to quantify the effects of alternative-energy

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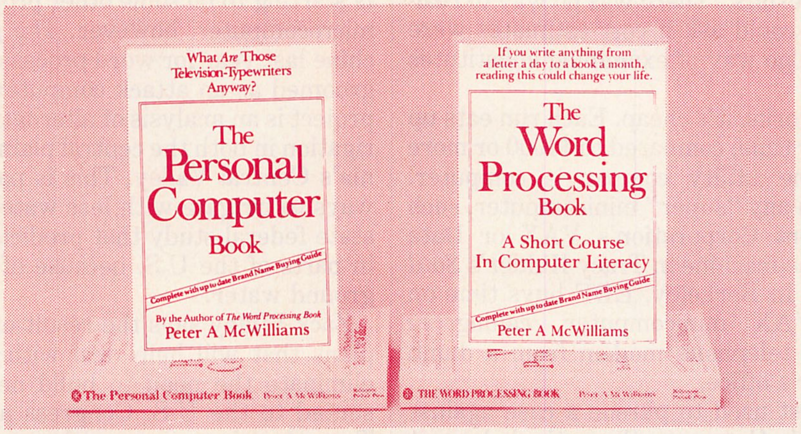
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proposals. Kirshner has continued to refine ELFIN into what is now a state-of-the-art model for analysis of alternative energy.

ELFIN Proves Its Worth

"Before we had the model, we were basically intimidated by the utilities in rate hearings," Kirshner says. "They'd present a run from their computer and say, 'These are the results.' There was no way to really challenge it. You could ask if cost estimates were realistic, but we had no way of examining substitutes and alternatives."

ELFIN not only works, it's cheap. Each run eats up only $12 of computer time, compared to $1000 or more for each run of the utility company's computer. ELFIN will work on any "super" minicomputer, such as Digital Equipment Corporation's VAX or Data General's Eclipse (the machine in Tracy Kidder's *Soul of a New Machine*). In Berkeley, EDF buys time on the university's VAX minicomputer, calling in through an acoustic telephone modem from a dumb terminal in Kirshner's office.

The model was first used to pursue a case against Pacific Gas & Electric Company, the nation's largest utility, in 1978 rate hearings in California. "PG&E did its best to brush it aside," Kirshner says, and although ELFIN didn't directly figure in the outcome of that hearing, it turned the California Public Utility Commission toward making conservation and alternative energy key considerations in future electrical expansion. California has, in fact, taken the lead among the 50 states in pushing for alternative energy and conservation, mainly at the prodding of the EDF and its partner ELFIN.

In 1980 EDF successfully used an ELFIN model to block construction of a proposed $5 billion complex that called for two coal-fired plants in Utah and Nevada. EDF contended that the power needed could be provided less expensively through a combination of conservation and available alternative energy sources such as wind and geothermal power. The utilities withdrew from the project before the Public Utility Commission (PUC) reached a decision, citing changed projections of power demands, but according to the PUC the EDF model was a decisive factor in killing the project.

ELFIN has also figured prominently in half a dozen other significant utility or legislative hearings in Florida, Illinois, Arkansas, Michigan, and most recently in New York, where EDF tried to halt construction of the partially completed Nine Mile Point No. 2 nuclear plant near Oswego.

The Nine Mile challenge was a departure for EDF. "Until Nine Mile we had basically been looking at plants that hadn't started," Kirshner explains. "We wanted to avoid committing good money to them until it was clear they were needed." As it turned out, EDF lost on that one; in February of last year the New York Power Commission decided to go ahead with the plant. However, the model did have some effect. The Power Commission included some of EDF's suggestions in its conditions for building the plant.

Irrigation Plans via Micro

ELFIN is small by mainframe-computer standards, but it's still too large to run on a microcomputer. EDF *is* starting to do some other projects on its North Star microcomputer, however. The group bought the machine last year for word processing, but it's now being groomed as an attack computer as well. One current project is an analysis of alternative methods of farm irrigation in both the central plains of Texas and California's Central Valley. This is part of a project to find ways to irrigate with less water; it ties in with a six-state federal study that predicts farming may die out in parts of the U.S. because of dwindling supplies of ground water.

Zack Willey says the result of this work—irrigation plans that will help deal with the salt problem and eliminate the need to build new dams—will be presented to the U.S. Congress and the California and Texas legislatures over the next two years in an attempt to bring about changes in policies for water use.

As anyone who has ever done it knows, to fight well is not necessarily to win. Although it gained in other ways, EDF lost its battle to stop the Nine Mile nuclear plant. And even with success in the air in Little Applegate Valley, the battle itself changed things in unforeseen ways. Ten month ago the Bachs sold their little piece of Shangri-la and moved to another, quieter spot in the Pacific Northwest.

"We desperately needed to be alone again, and I had to get back to work on the book that had just been stopped cold," Richard says. "What was supposed to have been a private little place to write and work from became the center of this great environmental movement. You'd get up in the morning and there'd be strangers in the house saying, 'Can we use the computer?' That was a little disconcerting after a few years."

Looking back, though, the Bachs have no regrets. Richard says the experience was a major education for him: "I have always been a retreater. If somebody wants the trees, let 'em cut the trees; I'll move. I have other things to do with my life that do not involve protests. But it turned out this was an opportunity for me to learn something about the power that we all have once we make up our minds to say no to some of the excesses that we see around us. We are an extremely powerful people in this country; every single citizen is powerful if each one says I will put my foot down at this point and devote some part of my life—in our case a huge percentage of our lives—to standing up against the cynical destruction of our country, of the country we have known. Couple that attitude with a tool like the computer and it's dynamite." □

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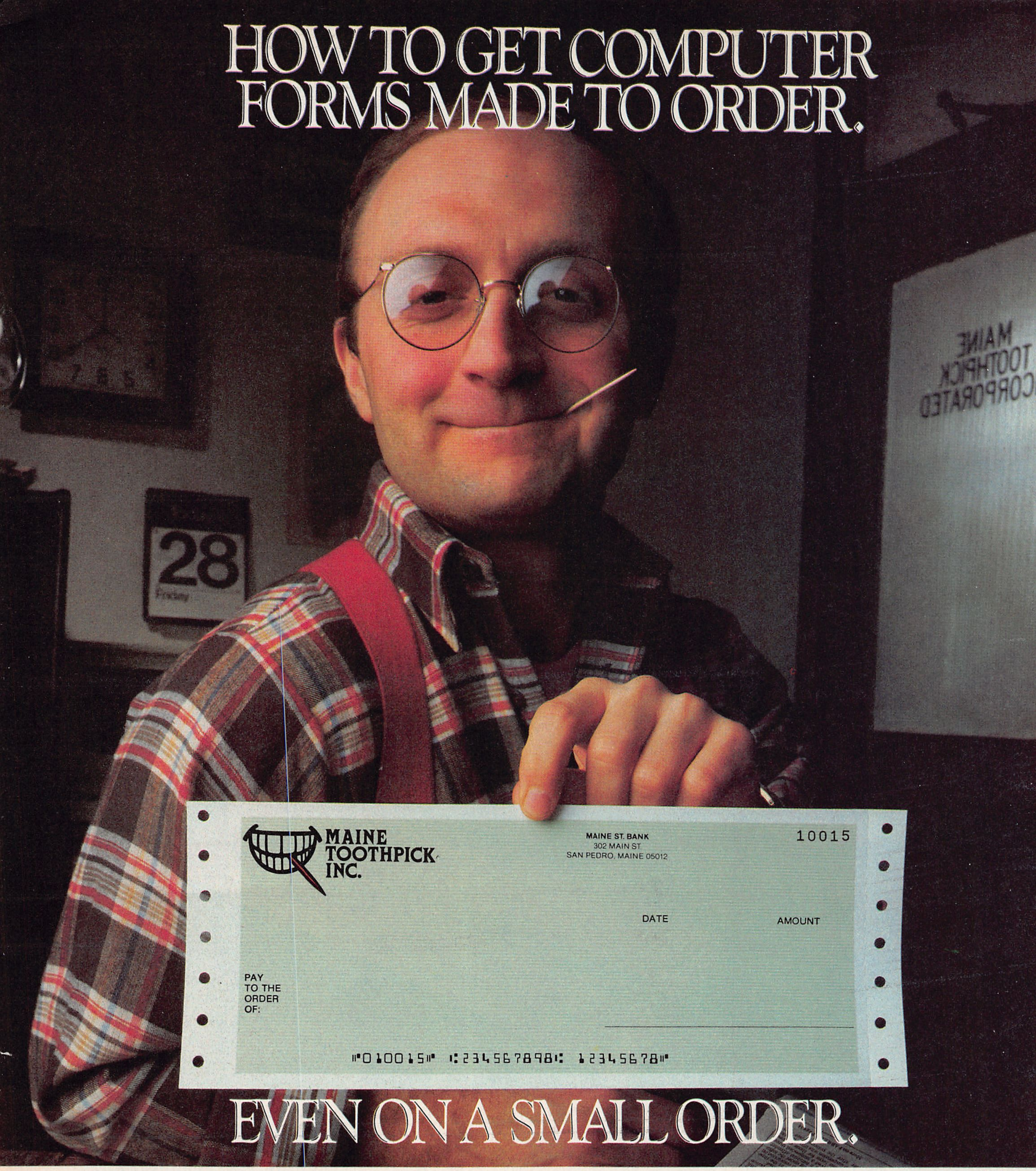
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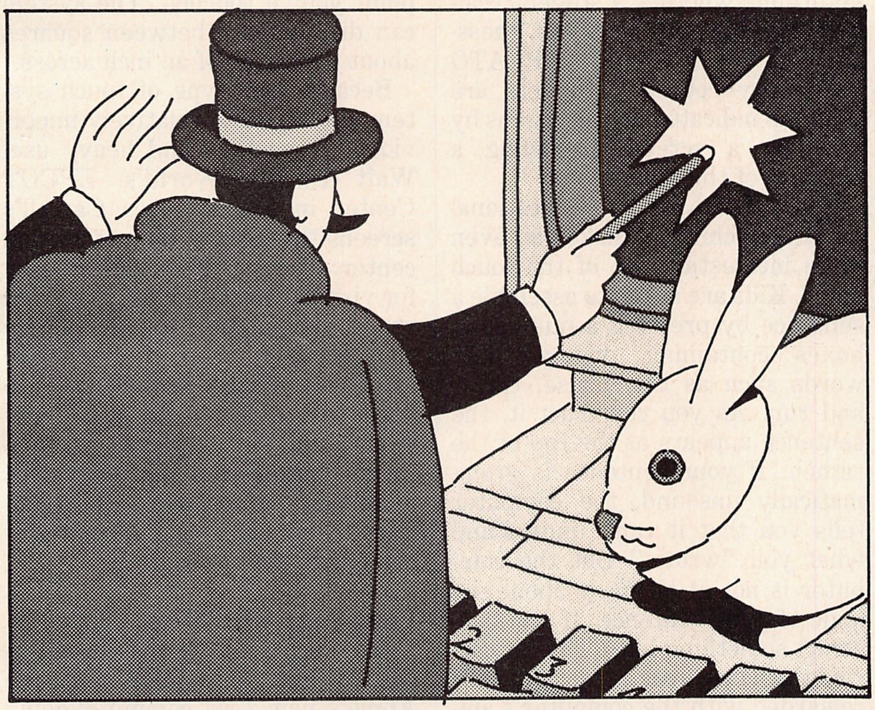
The Magic of Touch Technology Page 161
Does the Manual Measure Up? Page 166
Used Equipment: Buyers Beware Page 170
The Unix Operating System and Its Clones Page 174
Process Cost Accounting Page 178



The Magic of Touch Technology

Carl Sagan once said that if we were presented with the technology of an advanced civilization, we would find it indistinguishable from magic. Cause would be so far removed from effect that we would have no way of understanding how a particular device worked—or even if there was a device. Most likely the "device" would be invisible or perhaps woven into the clothing or implanted in the bodies (perhaps even in the genetic material) of its alien inventors.

E.T., today's most popular advanced being, and presumably his fellow extraterrestrials are somehow able to focus a force in their fingertips that, with a single touch, can instantly heal wounds of flesh and spirit. This highly evolved form of "kiss it and make it better" certainly seems magical.

Nearer to home, this sense of magic may be your reaction when you first try one of the new touch-sensitive computer screens. You lightly press your finger to a box on the display that says, perhaps, NEXT or A or B—and lo and behold, the screen changes to present you with the boxes or text you selected. Perhaps you find yourself in the middle of a game.

Is it magic? Well, after a fashion.

Touch technology has been evolving over the past ten years. We've seen some of the rudimentary forms of it in elevators and automatic bank tellers. One of the great benefits of touch-sensitive panels is that they make the computer extremely easy to operate. As Terry Smith of Carroll Touch Technology puts it, "The beautiful part is that touch technology allows individuals without typing skills to interact with the computer."

Computer touch-screen technology is based on the old principle of reading *x* and *y* coordinates on a grid. In one of the earliest types of touch panels, tiny transparent, conductive filaments are embedded or etched into the glass of the screen. When you touch the screen, you add your body's capacitance (somewhat like E.T.) and the electronics connected to the screen can determine the point you're touching. The computer then responds accordingly. This method is limited to identifying roughly 32 areas on the

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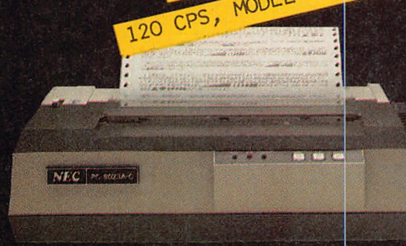

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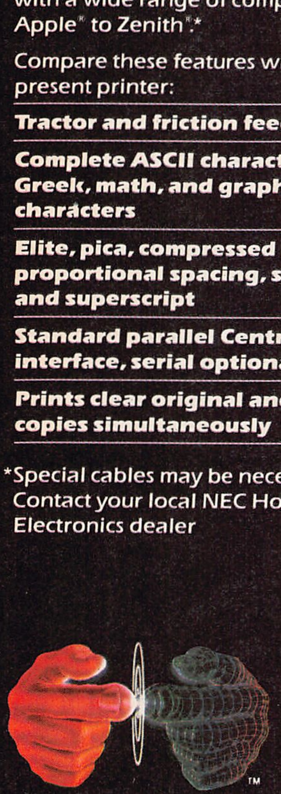

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screen, which is fine for many applications.

Control Data Corporation's PLATO educational systems use a similar screen in a variety of ingenious applications. When you are taking a test on one of the PLATO subjects, you press the box next to your answer. If you're correct, two more boxes appear. You press one if you feel you'd like to review the material later, or you press the other if you feel confident that you've mastered the material. This feature allows the program to determine whether a student really knows his stuff or is just guessing. In a test in one of the PLATO physiology courses, students are asked to indicate various organs by touching a screen displaying a diagram of the human body.

One of PLATO's educational games for children makes an even more interesting use of the touch panel. Kids are asked to assemble a sentence by pressing a number of boxes containing pictures and words such as cat, house, carry, and run. As you construct it, the sentence appears at the top of the screen. If your sentence is grammatically unsound, the computer tells you that it can't understand what you "wrote." But the computer is not at all fussy about the logic of your sentence. If you construct something like "The cat carried the house over a tree," you are rewarded with the computer's animation of a cat carrying a house over a tree. When you're ready to make a new sentence, you press a box with the word NEXT.

The Infrared Solution

The PLATO screen is protected by a sheet of clear Mylar that you depress slightly to make contact with the glass. One potential problem with this type of screen is that the Mylar could conceivably become scratched or torn with heavy use or warped by sharp temperature changes.

Carroll Touch Technology in Champaign, Illinois, has developed an ingenious alternative to the PLATO screen that avoids the problems of temperature and wear. Carroll's solution involves placing a frame around the screen. Two sides of this frame contain LEDs (light-emitting diodes) that send invisible infrared beams across the screen. These are detected by photosensitive cells mounted in the other two sides of the frame. When your finger touches a point on the screen, it interrupts both a vertical beam and a horizontal beam. These two interruptions provide the computer with the coordinates of the point you've touched. The system can discriminate between squares about a quarter of an inch across.

Because this type of touch system can be made relatively impervious to weather and heavy use, Walt Disney World's EPCOT Center in Florida uses Carroll's screens throughout its information center. The screens make it easy for visitors to manipulate maps and other information about where they are and where they want to go. These infrared screens are also used to control operations of the trans-Saudi and Alaska oil pipelines. Workers can shut off valves and start pumps along the pipelines by simply touching computer screens in the control room.

Competing with Mice

Are mice such as those used to control cursor movement on Apple's new Lisa computer going to compete with the infrared touch screens?

John Stetson, a spokesman for Carroll Touch Technology, puts it this way: "We cannot get the kind of resolution that a mouse or a joystick or a graphics pad can. They can achieve pixel-by-pixel resolution. However, those are mechanical devices, and AT&T and Disney didn't want mechanical equipment on their public screens at EPCOT because of the potentially destructive environment." This relative indestructibility of the infrared systems makes them a good bet for wide use in public applications.

So far the touch panels have not

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entered the home computer market, but there's nothing standing in their way. "As long as it accepts RS-232C signal output, we don't much care what the host computer is," says Stetson. In fact, Carroll has hooked up its system to a Sanyo 15-inch monitor and an Apple II Plus.

Fingerpainting with Light

The New England Technology Group (NETG), a Woburn, Massachusetts, company less than two years old, has developed yet another approach to touch-sensitive screens. This firm's design looks very promising for applications that require higher resolution than either the infrared or capacitive screens provide.

In this new approach, two conductive surfaces extend over the entire screen with a slight separation between them. The computer sets up a graduated field across the back surface. When you touch the screen, the pressure of your fingertip connects the two conductors. The front surface reads the back surface's voltage, which varies depending on where the contact was made. Because the back surface offers a graduated resistance, the computer can identify the precise point on the screen where contact was made. The system first sets up a horizontal field to read the coordinate on the x-axis and then creates a vertical field to provide the y-axis reading.

This method yields exceedingly high resolution. NETG systems designer Alan Rath says, "We can easily pick off 4000 points in either direction."

NETG's screens have been used in the U.S. pavilion at the World's Fair. A wall of 30 screens displayed a scrolling list of energy-related terms. When a visitor wanted to learn more about a particular term, he or she could actually touch it as it moved down the screen and the system would kick out to a videodisc that would define the chosen word. If visitors didn't understand certain words in the definition, they could touch them to learn their meanings too.

Another intriguing use of NETG's high-resolution screens is a system in the Pittsburgh Science Museum that enables museum visitors to "fingerpaint" on the screen. A software program detects and remembers all the points in each stroke across the panel. You can change or mix colors by typing certain keys, and temperamental artists can quickly do away with any botched works and start again.

Putting the Touch on Apple

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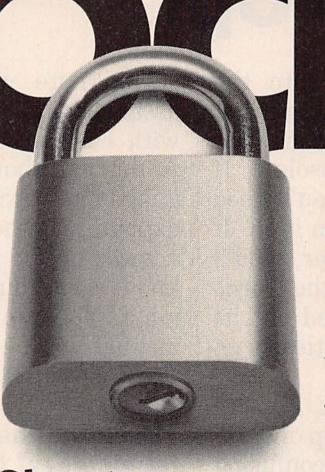

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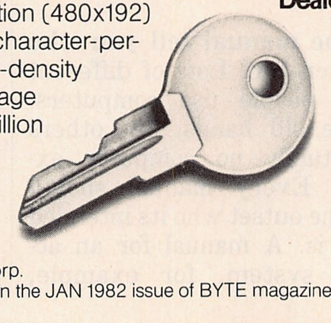

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screens in its new Apple Information Center—a promotional system to be offered to computer dealers across the country. A customer entering a computer store will see a screen with the words TOUCH ME flashing on it. When the customer yields to temptation and touches the screen, Dick Cavett appears in an introductory video segment. The system then offers the customer a menu of touch-activated video programs on such subjects as word processing, spreadsheets, and, of course, Apple products.

Apple spokesperson Kathleen Dickson describes the Apple Information Center as an "interactive laser videodisc system." The laser-read disc allows quick access to any of the programs on the menu. Dealers will be able to lease the Information Center for $165 a month or buy it outright for $3700 (Apple's cost). Apple currently plans to send a new videodisc every three months. Dealers, of course, will be able to employ the system in many ways, taking it to trade shows or using it as a teaching tool in the store.

Touch in the Future

Given what has already happened in the short life of touch-screen technology, you can easily imagine new video art forms, screens that vastly enhance the teaching power of computers, a profusion of applications in stores, and touch panels in many public places where complex information may be needed. You might also imagine some sort of touch screen used in the much anticipated home-balloting system—an instant plebiscite.

Whatever comes of these fanciful forecasts, we are likely to see more and more applications for the various types of touch screens. In a way the touch panel can be seen as the emblem of the age, the symbol of a technology that is becoming increasingly "magical" to all of us—and accessible to nearly everyone.

—John O. Green

Does the Manual Measure Up?

As if able to see into the future, many experts insist that some day soon computer manuals will be obsolete. If you buy a computer, all you'll need to do is plug it in and turn it on. If it's software you're after, you'll simply pop in a disk and the words or even pictures displayed on the screen will send you effortlessly on your way.

But we're not there yet. For the most part, the current crop of hardware and software is confusing enough—and the existing on-screen documentation primitive enough—to put even the cleverest of users at the mercy of manufacturers' manuals for understanding how computers and the programs that go with them work.

This need for adequate documentation is why as a matter of course you should insist that your dealer let you spend a few minutes checking out the manual that accompanies whatever product—be it hardware or software—you're thinking of buying. You won't have time to read the manual from cover to cover in most cases (although some manufacturers and retailers will sell you a manual without the product), but you should be able to check for certain key elements that every manual should include. If you find that the manual doesn't measure up, chances are the product itself may not be worth buying. Here's a list of questions you should ask yourself as you look over any manual:

•**Does the manual tell you who it's written for?** Lots of different kinds of people use computers. Some are old hands, but others have virtually no computer experience. Every manual should state at the outset who its intended audience is. A manual for an accounting system, for example, should note whether the author assumes that readers are familiar with basic accounting procedures. A manual about a computer language like BASIC or Pascal should explain whether it's written for novices or for people who already know something about programming. You can't tell how useful a manual will be for you unless you know if you're among the intended audience.

•**Does the manual use common terminology?** Of course, a certain amount of computer jargon is inevitable, but a manual shouldn't be mired in arcane lingo. If it is, chances are good that it's been written for programmers rather than typical users. Read a few pages just to see if you and the manual speak the same language. Also, see if there's a glossary and if its definitions make sense. An extensive and usable glossary is a sure sign that the manual writer has been sensitive to the needs of all potential users.

•**Does the manual contain hands-on instruction?** Manual writers talk a lot about *tutorials*—step-by-step instructions that you can follow when working with a particular product for the first time. When you first start using a computer program, a tutorial can be the most welcome of friends, taking you by the hand and carefully leading you through what initially appeared to be pretty treacherous territory.

Naturally, some tutorials are better than others. A good tutorial should feature a brief introduction telling you what you'll learn, plenty of photographs or illustrations of the actual information that you should see on your screen as you move through the tutorial, and clear instructions on how to correct errors (preferably in an easy-to-read list rather than buried in long

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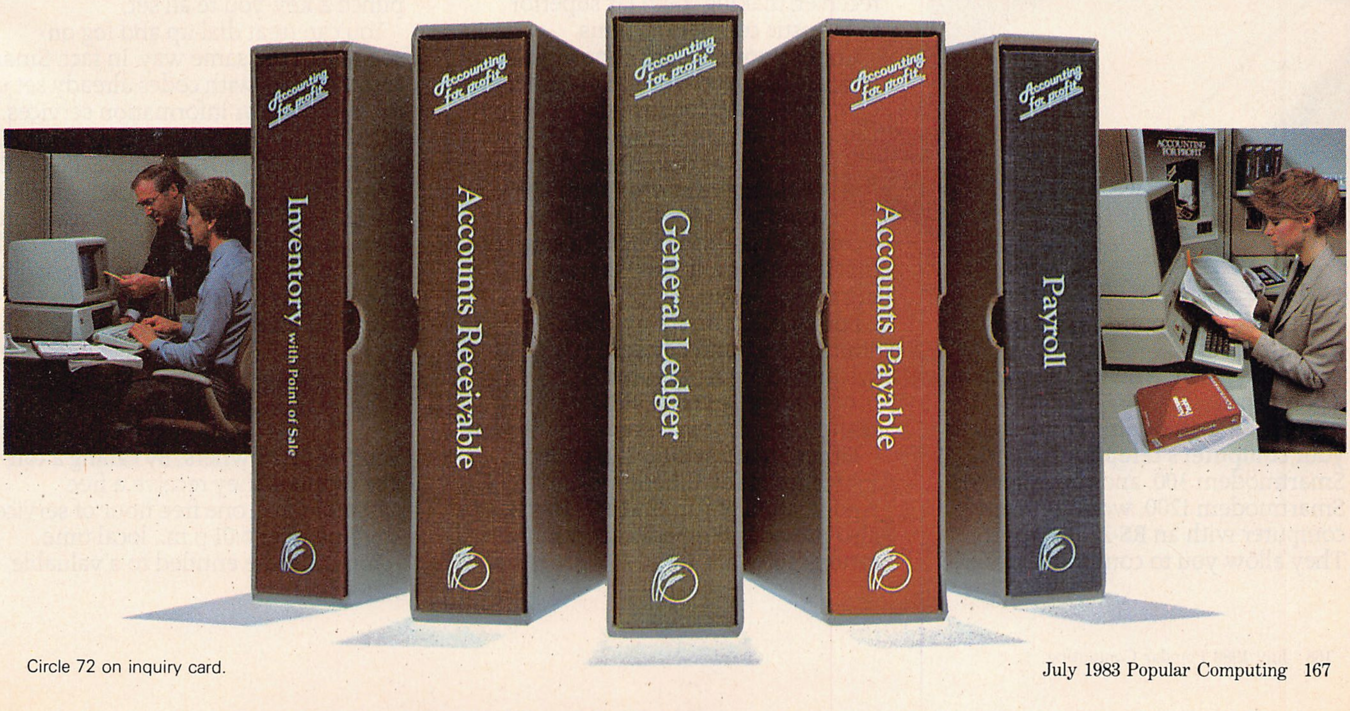
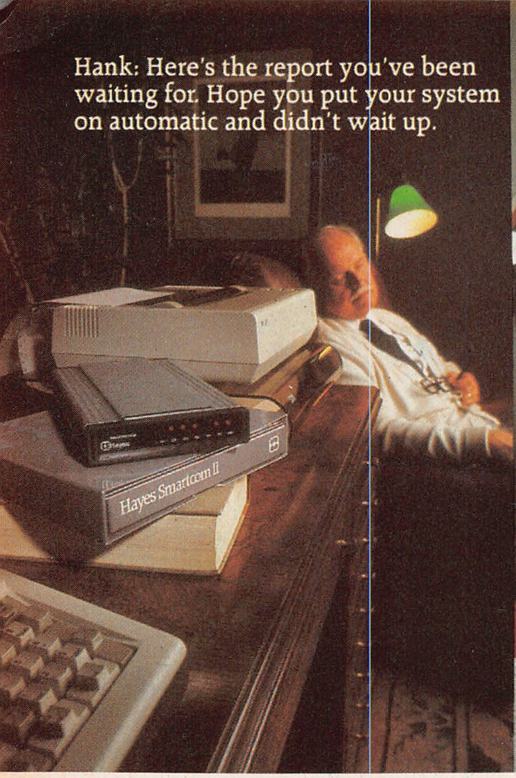
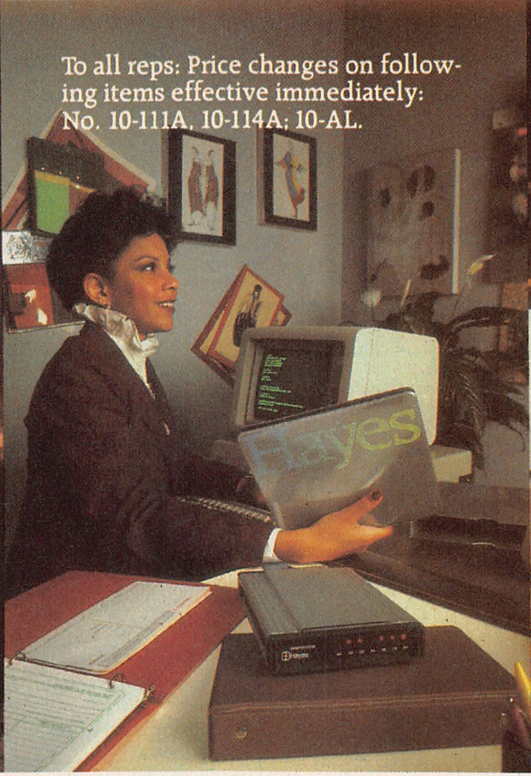
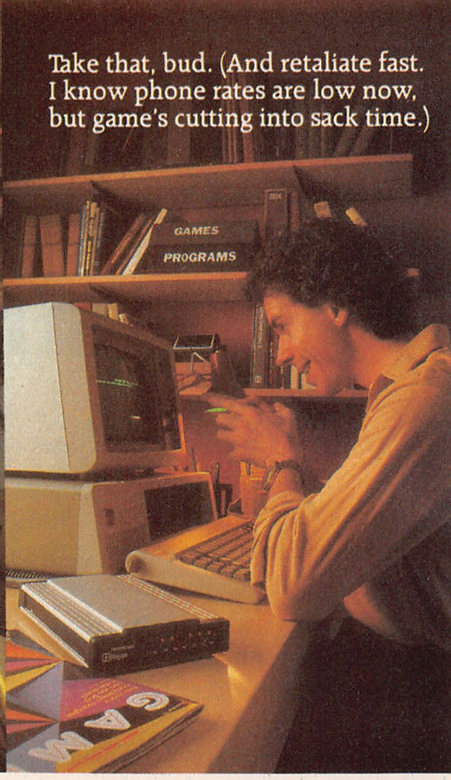

Accounting for profit
Inventory with Point of Sale
Accounting for profit
Accounts Receivable
Accounting for profit
General Ledger
Accounting for profit
Accounts Payable
Accounting for profit
Payroll
ACCOUNTING FOR PROFIT

Circle 72 on inquiry card.


Hank: Here's the report you've been waiting for. Hope you put your system on automatic and didn't wait up.


To all reps: Price changes on following items effective immediately: No. 10-111A, 10-114A; 10-AL.


Take that, bud. (And retaliate fast. I know phone rates are low now, but game's cutting into sack time.)

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Wouldn't it be great if, somehow, you could connect your computer to your accountant's, down the street? To the IBM** PC at the branch office, upstate? Or to your favorite chess challenger, across country?

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But any modem will send and receive data.

Smartmodems also dial, answer and disconnect calls. Automatically. Without going through the telephone receiver, making them far superior to acoustic coupler modems.

Choose your speed; choose your price. The lower-priced Smartmodem 300 is ideal for local data swaps and communicates at 300 bps. For longer distance and larger volumes. Smartmodem 1200 communicates at 1200 bps or up to 300 bps, with a built-in selector that automatically detects transmission speeds.

Both work with rotary dials, Touch-Tone* and key-set systems; connect to most timesharing systems; and feature an audio speaker.

Either Smartmodem is a perfect match for many different computers. And if you have an IBM PC, Hayes also provides the perfect communications software.

Smartcom II.™ We spent a lot of time developing our software, so you can spend less time using it. Smartcom II prompts you in the simple steps required to create, send, receive, display, list, name and re-name files. It even receives data completely unattended—especially helpful when you're sending work from home to office, or vice versa.

And if you need it, there's always "help." One of several special functions assigned to IBM function keys, this feature explains prompts, messages, etc. to make communicating extra easy.

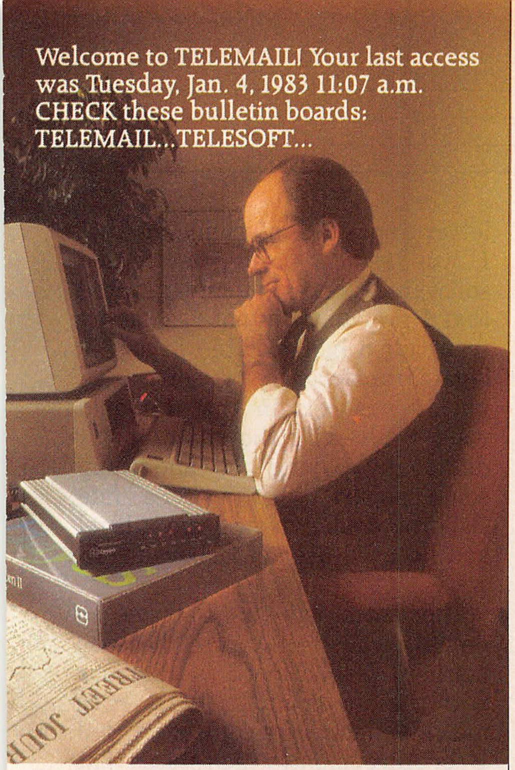
With Smartcom II, it is. The program remembers communication parameters for 26 different remote systems. Just punch a key, you're all set.

You can treat dial-up and log-on sequences the same way. In fact, Smartcom II comes with codes already set up for four popular information services. COMPUSERVE,® DIALOG'S KNOWLEDGE INDEX,℠ DOW JONES NEWS/RETRIEVAL SERVICE, and THE SOURCE,℠ AMERICA'S INFORMATION UTILITY.℠ Procedures for obtaining an account with each of the services are included in the Smartcom II manual. But that's not all.

Special offers for Smartcom II owners! Dow Jones News/Retrieval Service has a special introductory offer for Smartcom II owners. By calling a toll-free number, they receive a free password and one free hour of service anytime after 6:01 p.m., local time.

You'll also be entitled to a valuable

Hayes®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CHECK these bulletin boards:
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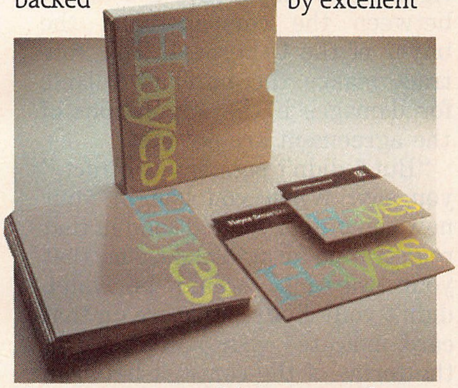
subscription offer for THE SOURCE. Smartcom II owners who subscribe to THE SOURCE will receive one free hour of daytime service.

Like all our products, Smartcom II and both Hayes Smartmodems are backed by excellent documentation and full support from us to your dealer.



So see him today. Break out of isolation. Get a telephone for your desktop computer.

Hayes Microcomputer Products, Inc.,
5923 Peachtree Industrial Blvd.,
Norcross, GA 30092. 404/449-8791.

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Circle 76 on inquiry card.

paragraphs). Finally, a good tutorial will have summaries for quick review at the ends of sections.

•**Does the manual include clear installation instructions?** Do these instructions include understandable diagrams? Nothing is more frustrating than bringing home a jazzy new piece of hardware only to find that the instructions for setting it up are so garbled that all you can do is shuttle the entire system back to the dealer and hope he'll have enough mercy on you to put the thing together himself. Lots of clear, well-marked diagrams or photographs can make all the difference when trying to set up an unfamiliar piece of equipment. Also check to see that the installation instructions are clearly delineated in sequential steps rather than jumbled together in rambling paragraphs.

•**Does the manual include a list of common errors?** Does it include instructions for correcting those errors? Unfortunately, many computer programs are still rife with cryptic messages like "I/O error #44" and "Character Device Not Open." A manual should not only tell you what caused the error, it should also explain how you can correct it. These common errors should all be listed in one place, preferably in alphabetical order, so you can locate them easily.

•**Does the manual have a complete index?** With the exception of very short manuals (5 to 10 pages), an index is a must. You probably won't want to read the manual from start to finish, and even if you do you certainly won't remember exactly where a particular piece of information was presented. That's why an index is crucial—it helps you rapidly find the information you need. But an incomplete index is almost as frustrating as no index at all. You can check the completeness of an index simply by making sure that certain key items are listed.

•**Does the manual include a reference card?** Once you've gotten the gist of a program, you probably won't want to waste time wandering through the manual for specific pieces of information. A reference card minimizes such searches. The most useful cards can be torn out of the manual and placed in easy reach beside the computer. If a manual doesn't have a reference card, it should at least offer a summary of the program's main commands.

•**Does the manual's layout enhance its readability?** In the old days, the archetypal computer manual was a three-ring binder filled with pages and pages of gray text. We've come a long way since then. Today, many manuals look as appealing as best-selling trade books, featuring eye-saving large type, plenty of lists, high-quality schematic diagrams, and inviting design. Many smaller computer companies cannot afford expensive graphics, but a book can still be readable and visually pleasing without being costly.

•**Does the manual have a sense of humor?** This is controversial. Some people insist that computers are serious business and manuals should be too. Other people like nothing better than to chuckle as they wade through the page-long explanation of why the pie chart displayed on the screen doesn't look round. Cartoons and whimsical headings are sure signs that the manual writer has a sense of humor. Whether you view this as a plus depends on your temperament.

Remember that these questions are only a set of guidelines. People have the same kind of idiosyncrasies about manuals as they do about the color of their cars or the doneness of their spaghetti. The point is, however, that by spending a few moments examining a manual you're giving yourself the opportunity to pass judgment on one of the most important components of a product—one all too often overlooked by prospective buyers. —Elizabeth Weal

Used Equipment: Buyers Beware

FOR SALE: TRS-80 computer, Level 2, 16K. Includes all original equipment, huge software library, cassettes including FS1 Flight Simulator, Super Nova, Sargon II, and 24 other programs (worth more than $450) plus a large number of typed-in magazine programs. $900 or best offer.

The classified ads in even the smallest communities now hawk "previously owned" Atari, Apple, or Radio Shack computers. As people begin to move up to bigger, more sophisticated machines, many inexpensive microcomputers move into the used-computer marketplace.

Many first-time computer owners are pleased at the prospect of buying an entire used system at one seemingly uncomplicated swoop. Free software. Wonderful, isn't it? Well, think again.

I speak from experience. A year ago I purchased a used Osborne 1 computer. It was a deal that I couldn't refuse. Soon I heard about some upgrading that Osborne Computer Corporation (OCC) would be doing. I wrote OCC, explained that I had a secondhand machine, and said that while I knew I would not be covered by the warranty, I'd appreciate information about the updates.

Read the Fine Print

In a few weeks I received a stern letter from OCC informing me that I was using "illegal, unlicensed software." The company granted that I probably did not realize my transaction had resulted in an "illegal transference of software," but it was certain that I would want to "rectify the situation." I did so by paying $50 and filing some papers with a bona fide Osborne dealer. Now I am a legal and licensed user of Osborne software.

The "situation," as Osborne so politely called it, arose because neither the seller nor I was familiar with the fine print. In its letter to me OCC included a copy of its End User Agreement, which states that if the end user, the owner of the Osborne 1, wants to sell the machine, he or she must notify OCC of that intent. Then the company will select the best method for transferal and determine how much it will cost.

The fine print of the "End User Agreement" is in fact a contract between the company and the buyer of the Osborne 1. This contract makes the purchaser liable for damages if the stipulations of the agreement are not met.

"But I didn't sign any contract," you say. When you bought your new computer, you did send in that registration form to make sure that your warranty would be valid, didn't you? Your signature on that card indicates your acceptance of the terms of the contract between you and the licensing agent.

If you're shopping around for a good deal on a used microcomputer or peripherals, be wary. The hardware is not a problem, but the software often is. In most cases it is licensed to the original purchaser to be used only on one specific computer. Not all software has these restrictions, but the more popular the software, the more restrictions there will be on the program. Be sure to ask the seller for any registration information so that you can be sure you're the bona fide owner of every part of your system. —George Brett

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Kay Pro II
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IBM PC
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MEMORY BOARDS

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Combo Plus. 4 function card. Fully pop. 256K	**$490**
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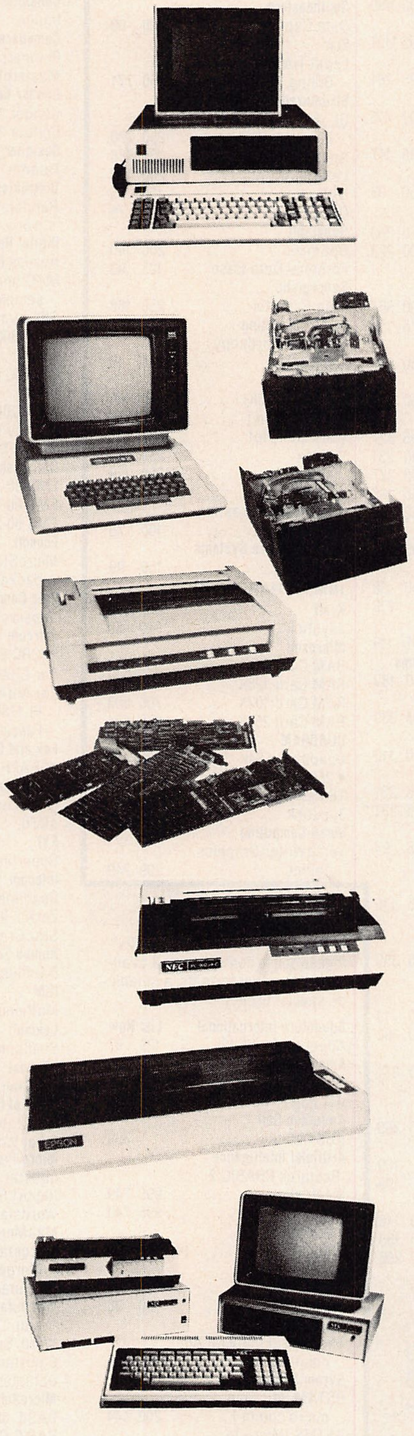

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IF YOU KNOW WHAT YOU WANT. . .

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Spellstar	[4]	250	165
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The Unix Operating System and Its Clones

A look at the ads in most computer magazines brings home to even the casual reader the fact that another operating system is becoming almost as common as the better-known CP/M. Called Unix, this operating system and its clones offer advanced features and an internal structure that make its implementation on more and more computers both desirable and feasible.

The speed with which Unix has spread throughout the computer world—first in minicomputers, then mainframes, and now in 8-, 16-, and 32-bit microcomputers—has been phenomenal. In many respects, its adoption is the industry's response to a grass-roots demand from professional programmers for a better programming environment.

A *programming environment* is the set of tools programmers use to create, modify, debug, archive, transmit, copy, and share programs. In the mainframe world, the operating systems offering programming environments most comparable to Unix are TSO and VM/CMS. Unix, however, was originally developed by Bell for the widely used PDP-11, a 16/32-bit minicomputer from Digital Equipment Corporation.

All three operating systems arose in the late '60s and early '70s and were initially based on some of the same improvements over previous systems. Of the three, Unix now features the most advanced programming environment thanks to its unique structure. Most operating systems are made up of modules, but the outstanding feature of Unix is that its various modules all fit together easily, making interconnection of them a simple procedure. Programmers can plug any module into any other one in virtually any way, which means that anybody can add a function to the system by writing and plugging in an ordinary program. No special procedures are required to incorporate the new function. In TSO and VM/CMS, new programs are more difficult to incorporate into the operating system. In Unix, only one simple command is needed.

This ease of modification has been responsible for the rapid spread of Unix. Recent genera-

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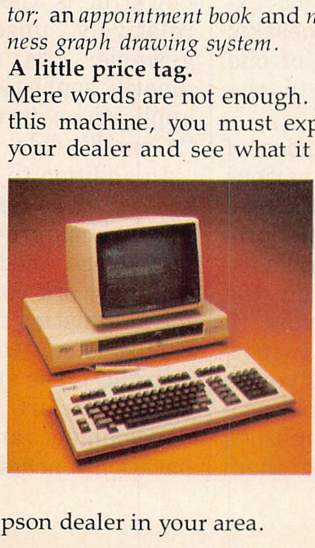

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tions of professional programmers trained in university and college computer science departments—where they had used Unix free of cost—have been the chief proponents of the system.

What Is Unix?

Unix comprises three basic structural entities: the *kernel*, the *shell*, and the *command structure*. The kernel is the true operating system, driving the hardware and providing timing services. It coordinates users, manages memory, and queues input/output calls. The shell is a program that monitors timesharing and handles interactions with the user at the terminal. The command structure is a library of commands and programs.

A key feature of Unix is its file system, a hierarchical tree structure with many pointers that provide a lot of flexibility for users. For example, by using pointers users can share their files with some fellow users while excluding others. Although there may be only one physical copy of a particular file, different users can have their own names for the file and can even call it up using those names.

A second important feature is the processing capability of Unix. In Unix a process is simply a unit of work, be it a command or a subprocedure spun off from a command. Unix allows programmers to connect different processes in a logical chain called a *pipe*. A pipe has exactly the function of its namesake: it ensures that the output of one command flows as input to the next.

Let's say you have a series of programs that perform various operations on text. Using a pipe you can pass text from one program to another while each performs its specified task on the material. Rather than having to write one large program to perform all tasks, a pipe allows you to write a series of very simple programs, each of which accomplishes one task, and then hook them together. Connecting these programs using a pipe is no more complicated than entering the command A/B/C. . . , where A, B, C, and so on are the programs to be linked. At each end of the pipe there needs to be a starting point and a destination (a place to store the result), which may be indicated by *redirect* commands. Thus you need not worry about buffering, formatting, or other nagging concerns. Moreover, any program can take its input from the terminal, from the disk, or from another program and direct its output to another terminal, disk, or program. It's just a matter of creating the pipe and redirecting each end.

What the programmer has, then, is a collection of single-function programs in their software pigeonholes. To perform a complex series of functions, all the Unix programmer has to do is choose the appropriate limited-function programs, hook them together in a pipe, and execute.

The third significant feature of Unix lies in the nature of the command language and its control of that library of pigeonholed programs. Parsing a command language for a given application is normally a tough job, equivalent in complexity to parsing a high-level language in a compiler. The pigeonhole approach, however, can also be used by the programmer to build a specific applications program's command structure. So powerful is this approach that a relatively unsophisticated programmer can build an extraordinarily sophisticated and powerful applications program using these "canned" tools.

In addition to the obvious necessities such as text editors and compilers, Unix provides tools for day-to-day use (electronic mail, calendar, network communications) and for automating frequent tasks (file comparison, searching, sorting, counting). The system also features state-of-the-art tools for program development and document preparation, including programs for text formatting, table preparation, citation searches, and spelling correction. Other programs examine a document for split infinitives, clichés, use of the passive voice, sexist phrases, and numerous other flaws.

Program Portability

A major benefit of Unix is its portability. A program written on a microcomputer can be recompiled to run on a minicomputer or a mainframe, and vice versa (given enough memory space). Furthermore, not only the program but also the unique programming environment is portable. This means that programmers trained in the Unix environment are also portable to any place Unix is being used, whether it's on microcomputers, minicomputers, or mainframes. It is not necessary for the programmer to learn a new language, operating system, or command structure.

Companies no longer have to find programmers to fit a specific language and operating system. With Unix and the closely associated language known as C, they have a combination that most new programmers have worked with quite extensively. This means no learning period and no expensive retraining.

The main reason that Unix and its numerous clones are so portable is C, the programming language in which they are written.

A structured programming language lending itself to systems programming as well as more mundane programming tasks, C was designed to yield code that approaches machine language in density and efficiency while still offering high-level language features such as structured programming and systems-programming capability. Because C is rather simple and very compact, it can be described briefly and learned quickly. Because a compiler for C can be short and simple, it is easy to write. Using current technology, a professional programmer can pre-

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Dynax A DIVISION OF KANEMATSU-GOSHO (U.S.A.) INC. 5698 Bandini Blvd., Bell, California 90201 pare a compiler for a new machine in no more than a few months. And although C matches the capabilities of many computers, it is independent of any particular machine's architecture, making it easy to write portable programs.

In its purest form (that is, one of the versions available from Bell), Unix finds two main applications: as a very powerful text-processing system and as an extremely capable and flexible programming tool. Within Bell, Unix's document-preparation programs are used for creating virtually all textual materials. The programs have also been adopted by universities, industries, and professional societies around the world.

Professional programmers who use Unix prefer it to almost any other programming environment because it allows them to be extremely productive. However, as a programming tool for today's personal and small-business microcomputers, Unix in its original form is not without serious drawbacks. First of all, it is an operating system designed specifically for a 16/32-bit environment. Versions of Unix developed for 8-bit machines are only faint images of the original, with fewer of its powerful features. Second, microcomputer Unix can be extremely unfriendly to beginning programmers. Third, in most of the versions available from Bell, the hierarchical file structure is extremely fragile, lacking adequate file protection in case of a system crash; this clearly makes it untrustworthy for most commercial applications. Fourth, if the system does crash, it is difficult for even the most sophisticated programmer to rebuild the linked list that delineates the hierarchical file structure. Other less serious but nonetheless irritating drawbacks include inconsistencies in command names, language, functions, and syntax. The command names, formats, and syntax seem to have no clear relationship to their actual functions.

Because of these limitations, it should come as no surprise that numerous Unix clones—as many as 40 by one count—have been developed in attempts to retain the system's strong points while at the same time eliminating the drawbacks. Some firms that sell such clones are licensed by Bell and have merely modified the system for use on a particular computer; others, however, offer their own "Unix-like" systems that incorporate many Unix features together with various improvements. Ironically, these Unix-like systems were developed using the C programming language.

Freezing the Kernel

The major strength of Unix is the ease with which it can be adapted to different requirements and modified to eliminate various drawbacks. Ironically, this is also its greatest weakness, for it has led to a considerable corruption of what can only roughly be termed "standard" Unix. Unlike CP/M, which has been relatively unchanging through the years, Unix as made available under license from Bell has gone through at least five different versions. Most varieties of Unix, both licensed and unlicensed, have their roots in one of these four or five versions. This has weakened Unix's claim to true portability because an application developed with a particular version of Unix is portable only to systems using the same version.

Recently, however, Bell has taken steps to rectify this. With its most recent versions, the company has announced that henceforth the Unix operating system's kernel will be "unalterable." The goal in freezing the Unix kernel is to encourage software developers to write Unix-based applications secure in the knowledge that any program written for the most recent versions will run on any future Unix release. —Bernard Cole

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Process Cost Accounting

Whenever anything is mass produced—aspirin, alcohol, gasoline, fertilizer, medicines, baked goods, you name it—the production process typically involves an ordered series of operations. Logically, the firms that manufacture such products are usually organized into departments according to the various stages of the manufacturing process. To complement this reasonable approach, we designed a simple BASIC program that we call *process cost accounting* to calculate and monitor the unit cost of a product and to apportion the cost accurately to the various departments.

Stated simply, the program presented here shows how process cost accounting can be accomplished with a personal computer. But before using the program, you'll need a little background information and definitions of a few terms.

Apportioning Costs

Proper accounting procedures as well as tax regulations demand that product costs be apportioned between inventories on hand and the goods sold. The inventories may be of three types: raw materials, work in progress, or finished goods. The last two are more complicated because their valuation includes the cost of labor and overhead on top of the basic cost of materials.

For example, assume that the

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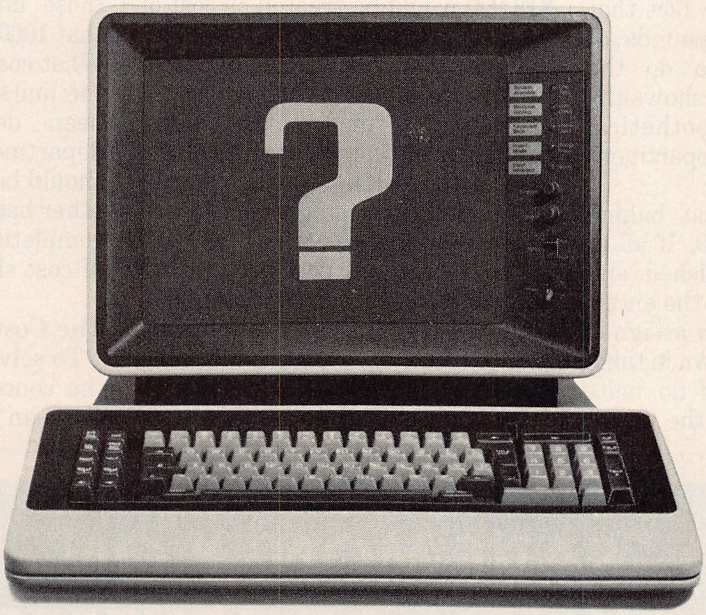

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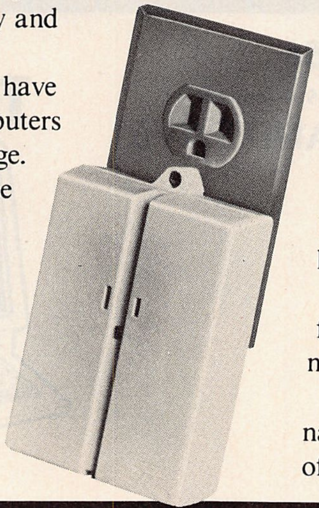

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operation of a bakery involves two steps: mixing and baking. When the mixing department finishes preparing the bread dough, the product is transferred to the baking department. When the bread has been baked and packaged, it is shipped to customers.

In process cost accounting, there's no time to savor the aroma of the fresh bread. Instead, we must concentrate on the fact that as the physical units (pounds of bread dough) move, so do the associated costs. Table 1 shows the apportionment of hypothetical costs to the baking department over one month.

In table 1 we see that baking must account for $12,800. If all of the units had been finished and shipped this month, then the entire amount would have been assigned to cost of goods sold (shown in table 2). In similar fashion, if no units had been finished, then the entire $12,800 would be treated as cost of work in progress (a sad state of affairs for our perishable loaves of bread). However, in the majority of cases only a small portion of the product is incomplete, and the total cost of the baking operation must be divided between goods sold and work in progress.

Table 1: Monthly costs apportioned to the baking department.

Costs of beginning inventory		**Costs added this month**		**Totals**
Dough from mixing	$1500	Dough from mixing	$5000	$6500
Added materials, baking	600	Added materials, baking	1800	2400
Added labor and overhead, baking	900	Added labor and overhead, baking	3000	3900
Total beginning inventory	$3000	Total added cost	$9800	$12,800

This situation poses a rather complicated accounting problem. Suppose 5000 units (in our example, pounds of bread) have been finished, transferred, and shipped; it is simple enough to assign cost to those units. But suppose further that 1000 units are still in progress. What cost do we assign to these? If the units of bread dough have just been delivered to the baking department, then very little cost should be attached to them. On the other hand, if they are just short of completion, then almost a full unit of cost should be allowed.

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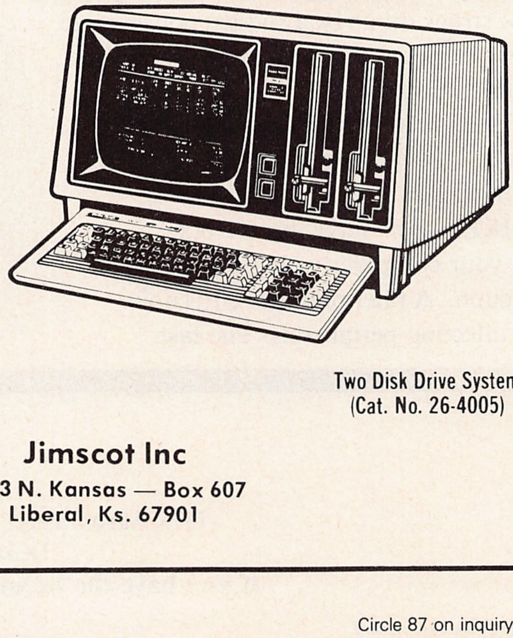

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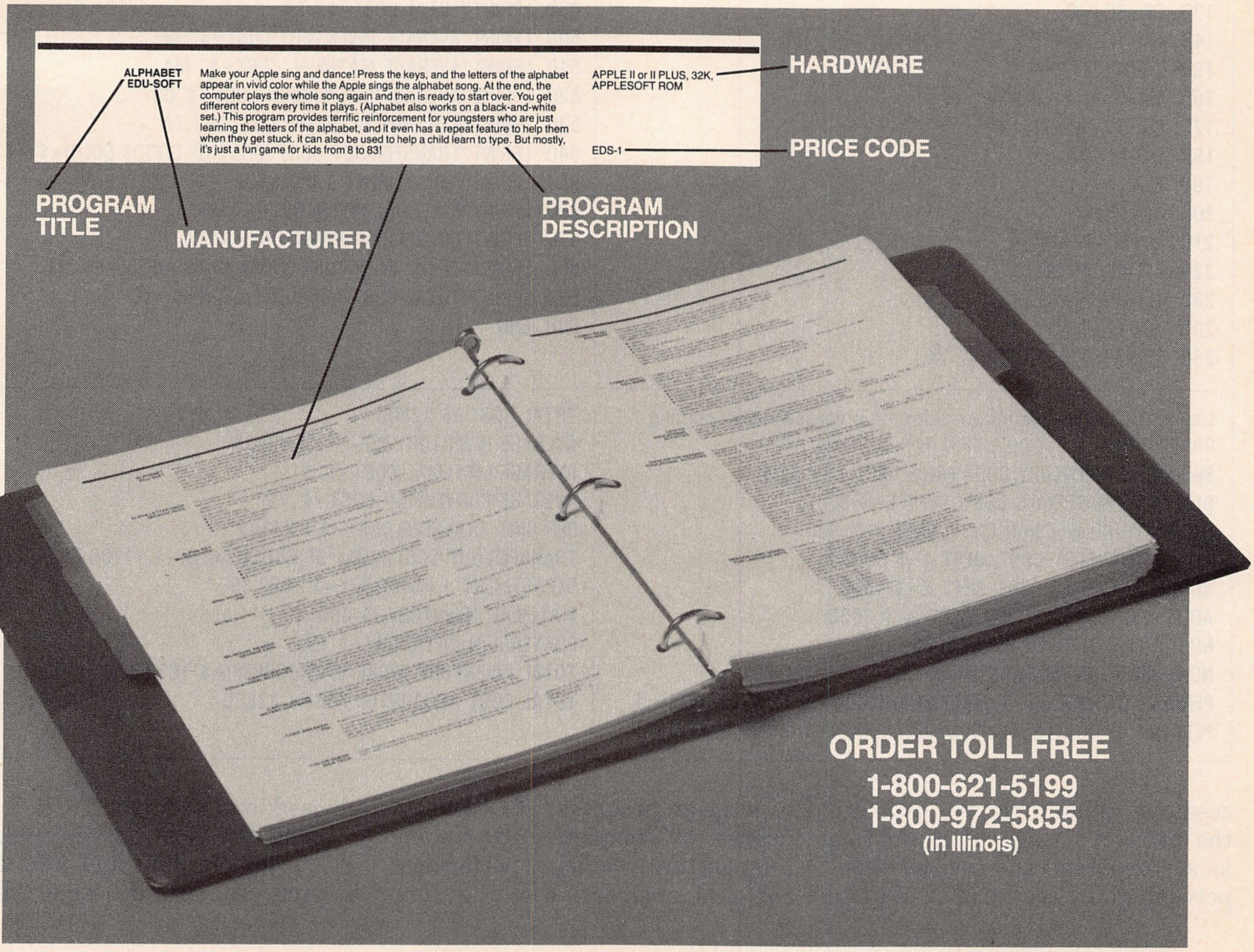

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Listing 1: This BASIC program performs process cost accounting computations.

```
  1 PRINT TAB(10) "PROCESS COST ACCOUNTING
    COMPUTATION"
  2 PRINT TAB(10) "(C) 1983 POPULAR COMPUTING MAGAZINE"
  3 PRINT
  4 PRINT "THIS PROGRAM COMPUTES THE MONTHLY COST
    ALLOCATION FOR"
  5 PRINT "A DEPARTMENT BASED ON BEGINNING COSTS AND
    ADDED COST"
  6 PRINT
 10 INPUT "BEGINNING INVENTORY COST FROM DEPT 1"; BI
 20 INPUT "BEGINNING MATERIALS COST, DEPT 2"; BM
 30 INPUT "BEGINNING CONVERSION COST, DEPT 2"; BC
 40 INPUT "ADDED INVENTORY COST, DEPT 1"; AI
 50 INPUT "ADDED MATERIALS COST, DEPT 2"; AM
 60 INPUT "ADDED CONVERSION COST, DEPT 2"; AC
 70 INPUT "NO. OF TRANSFERRED UNITS"; TR
 80 INPUT "NO. OF UNITS IN PROCESS"; PR
 90 INPUT "PERCENT OF MATERIALS COMPLETED (100%=1,
    50%=.5, ETC)"; MP
100 INPUT "PERCENT OF CONVERSION COMPLETE (100%=1,
    50%=.5, ETC)"; CP
110 TI=BI+AI
120 TM=BM+AM
130 TC=BC+AC
140 TX=TI+TM+TC
150 IN=TI/(TR+PR)
160 MA=TM/(TR+(PR*MP))
170 CO=TC/(TR+(PR*CP))
180 TA=IN+MA+CO
190 TT=TA*TR
200 DP=PR*IN
210 MI=PR*MP*MA
220 CI=PR*CP*CO
230 TI=DP+MI+CI
240 TC=TT+TI
250 PRINT"TOTAL COST=$" TX
260 PRINT"AVERAGE INVENTORY COST=$" IN
270 PRINT"AVERAGE MATERIAL COST=$" MA
280 PRINT"AVERAGE CONVERSION COST=$" CO
290 PRINT"PER UNIT TRANSFER COST=$" TA
300 PRINT"TRANSFER-OUT COST (COST OF GOODS SOLD)=$"TT
310 PRINT"DEPARTMENT 1 INVENTORY=$" DP
320 PRINT"MATERIAL INVENTORY=$" MI
330 PRINT"CONVERSION INVENTORY=$" CI
340 PRINT"TOTAL INVENTORY (WORK IN PROGRESS)=$" TI
350 PRINT"TOTAL COST ACCOUNTED FOR=$" TC
360 INPUT "TYPE 1 FOR A PRINTED COPY, TYPE 0 TO QUIT"; X
370 IF X=1 THEN 390
380 END
390 LPRINT "BEGINNING INVENTORY COST FROM DEPT 1=$"; BI
400 LPRINT "BEGINNING MATERIALS COST, DEPT 2=$"; BM
410 LPRINT "BEGINNING CONVERSION COST, DEPT 2=$"; BC
420 LPRINT "ADDED INVENTORY COST, DEPT 1=$"; AI
430 LPRINT "ADDED MATERIALS COST, DEPT 2=$"; AM
440 LPRINT "ADDED CONVERSION COST, DEPT 2=$"; AC
450 LPRINT "NO. OF TRANSFERRED UNITS"; TR
460 LPRINT "NO. OF UNITS IN PROCESS"; PR
470 LPRINT "PERCENT OF MATERIALS COMPLETED (100%=1,
    50%=.5, ETC)="; MP
480 LPRINT "PERCENT OF CONVERSION COMPLETE (100%=1,
    50%=.5, ETC)="; CP
490 LPRINT"TOTAL COST=$" TX
500 LPRINT"AVERAGE INVENTORY COST=$" IN
510 LPRINT"AVERAGE MATERIAL COST=$" MA
520 LPRINT"AVERAGE CONVERSION COST=$"CO
530 LPRINT"PER UNIT TRANSFER COST=$" TA
540 LPRINT"TRANSFER-OUT COST (COST OF GOODS SOLD)=$"TT
550 LPRINT"DEPARTMENT 1 INVENTORY=$" DP
560 LPRINT"MATERIAL INVENTORY=$" MI
570 LPRINT"CONVERSION INVENTORY=$" CI
580 LPRINT"TOTAL INVENTORY (WORK IN PROGRESS)=$" TI
590 LPRINT"TOTAL COST ACCOUNTED FOR=$" TC
600 END
```

Listing 2: This sample output from the process cost accounting program uses the hypothetical data in tables 1 and 2.

```
BEGINNING INVENTORY COST FROM DEPT 1=$ 1500
BEGINNING MATERIALS COST, DEPT 2=$ 600
BEGINNING CONVERSION COST, DEPT 2=$ 900
ADDED INVENTORY COST, DEPT 1=$ 5000
ADDED MATERIALS COST, DEPT 2=$ 1800
ADDED CONVERSION COST, DEPT 2=$ 3000
NO. OF TRANSFERRED UNITS 5000
NO OF UNITS IN PROCESS 1000
PERCENT OF MATERIALS COMPLETED (100%=1, 50%=.5, ETC)= 1
PERCENT OF CONVERSION COMPLETE (100%=1, 50%=.5, ETC)= .2
TOTAL COST=$ 12800
AVERAGE INVENTORY COST=$ 1.08333
AVERAGE MATERIAL COST=$ .4
AVERAGE CONVERSION COST=$ .75
PER UNIT TRANSFER COST=$ 2.23333
TRANSFER-OUT COST (COST OF GOODS SOLD)=$ 11166.7
DEPARTMENT 1 INVENTORY=$ 1083.33
MATERIAL INVENTORY=$ 400
CONVERSION INVENTORY=$ 150
TOTAL INVENTORY (WORK IN PROGRESS)=$ 1633.33
TOTAL COST ACCOUNTED FOR=$ 12800
```

cess cost accounting. We estimate the product's stage of completion as a percentage and multiply that percentage by the number of units of work in progress. We estimate degree of completion by taking temperature readings, performing chemical analyses, counting time elapsed, and so forth.

Using the previous example of 5000 complete units and 1000 units in progress, let's do some typical

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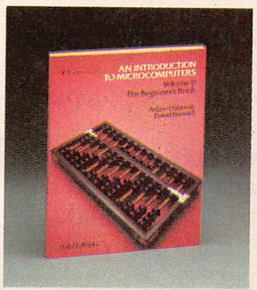

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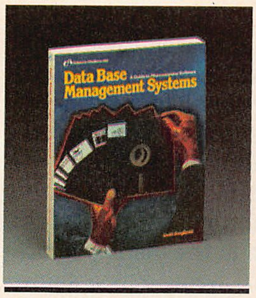

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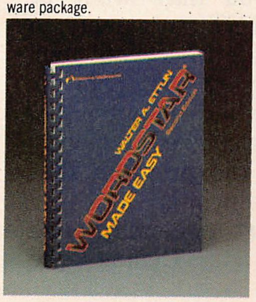

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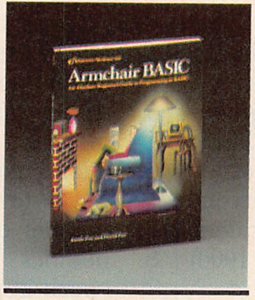

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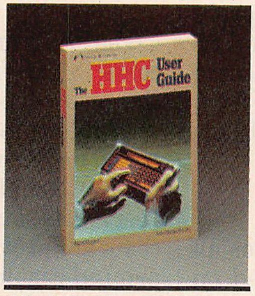

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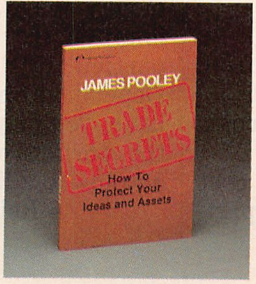

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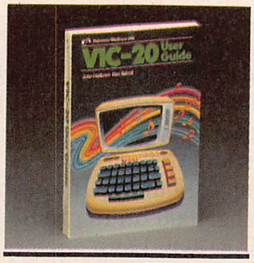

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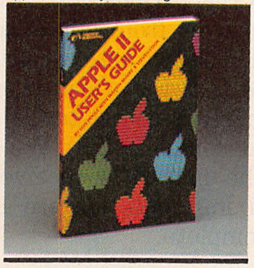

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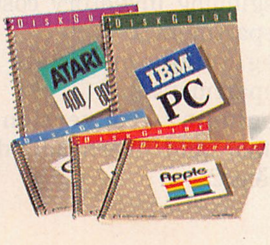

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Table 2a: Allocation of costs assuming 20 percent completion of work in progress.

Cost to be allocated		Cost of goods sold	Cost of work in progress
Dough from mixing	$6500	$\frac{5000}{6000} \times 6500 = 5416.67$	$\frac{1000}{6000} \times 6500 = 1083.33$
Added materials for baking	$2400	$\frac{5000}{6000} \times 2400 = 2000$	$\frac{1000}{6000} \times 2400 = 400$
Added baking labor and overhead	$3900	$\frac{5000}{5200} \times 3900 = 3750$	$\frac{200}{5200} \times 3900 = 150$
Total	$12,800	$11,166.67	$1,633.33

Table 2b: Allocation of costs assuming 85 percent completion of work in progress.

Cost to be allocated		Cost of goods sold	Cost of work in progress
Dough from mixing	$6500	same as above = 5416.67	same as above = 1083.33
Added materials for baking	$2400	same as above = 2000	same as above = 400
Added baking labor and overhead	$3900	$\frac{5000}{5850} \times 3900 = 3333.33$	$\frac{850}{5850} \times 3900 = 566.67$
Total	$12,800	$10,750	$2050

calculations. Suppose you estimate that the 1000 units are 20 percent complete. This gives us an equivalent production of 5000 + (.20 × 1000) or 5200 units. If, on the other hand, the 1000 units are 85 percent complete, we have an equivalent production of 5000 + (.85 × 1000) or 5850 units.

Table 2 shows how this approach affects the various cost categories carried over from our example in table 1. The two sets of calculations assume that the work in progress is 20 percent complete (2a) and 85 percent complete (2b). We assume that the materials received from the mixing operation are 100 percent complete.

The BASIC Program

The program in listing 1 does all the calculations for you, based on the six cost figures and the estimates for the stage of completion of the units in inventory. The program asks for the following information:

1. beginning inventory cost from department 1
2. beginning materials cost, department 2
3. beginning conversion cost (labor and overhead), department 2
4. added inventory cost from department 1
5. added materials cost, department 2
6. added conversion cost (labor and overhead), department 2
7. number of transferred units
8. number of units in process (work in progress)
9. percentage of completion for materials
10. percentage of completion for conversion

The program allocates inventory costs to materials, conversion, and the prior department (department 1). Ending inventory is computed based on per-unit costs and percentage of completion. All totals with respect to inventory and transfer costs are proven in the displayed or printed results. Listing 2 is a sample of the program's output.

The program should run on any computer that uses Microsoft BASIC, but you may want to modify the PRINT statements to improve the appearance on your particular display or printer. Depending on what computer you have, you may also need to modify the portion of the program that outputs to a line printer.

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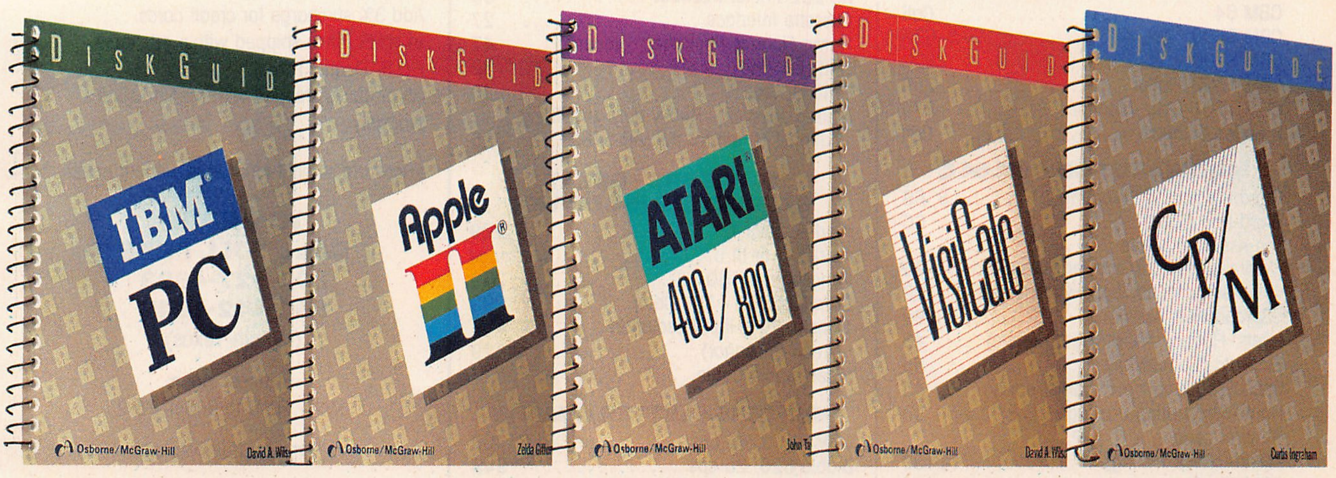

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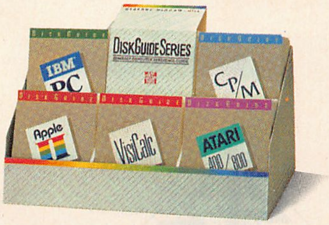

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Eliza

Turn your computer into a therapist

by Shelly Heller and
Judith Axler Turner

All of us who love our computers (and most of us do, dearly) get pleasure both from using them and from showing them off. We like to have others admire our toys.

Perhaps that's why we spend so much time with other computerists. They understand enough to admire. Noncomputerists often find it hard to fathom what we find so marvelous, which limits our conversation and demonstrations when the uninitiated are about.

Scientists at the Massachusetts Institute of Technology had the same problem in the early computer days of the mid-1960s. They had just begun timesharing, and the idea of making computers widely available was exciting. They wanted a way to spread their excitement.

So Joseph Weizenbaum, an MIT luminary in computer science, wrote Eliza, a computer program for mainframes that converses in English. It analyzes messages typed in by computer users, then composes a response based on certain rules of grammar and repetition of words.

Eliza was a wild success, mainly because it was easy to demonstrate and could be operated by computer novices. As Weizenbaum wrote: "Most other programs could not vividly demonstrate the information-processing power of a computer to visitors who did not already have some specialized knowledge, say, of some branch of mathematics. Eliza, on the other hand, could be appreciated on some level by anyone. Its power as a demonstration vehicle was further enhanced by the fact that the visitor could actually participate in its operation."

A Personalized Program

It was this universal appeal that drew Steve Grumette to Eliza. Grumette first became interested in computers after microcomputers were developed. He had decided early on that if microcomputers ever became popular, Eliza would find a ready market.

"It took a few years for me to get around to it because I knew very little about computers at first," Grumette said from his home in Los Angeles.

Grumette studied BASIC, studied Eliza, and rewrote Eliza in BASIC. "My version of Eliza is functionally identical to the one Weizenbaum wrote," Grumette said. "It's not stripped down."

Grumette, the president of Artificial Intelligence Research Group, sells two versions of Eliza, one protected and one unprotected. Don't buy the protected version. For the extra $20 you get a chance to look at the program, marvel at

---

Shelly Heller and Judith Axler Turner write a syndicated column on computing for the Gannett News Service.

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its simplicity, and even change it. Changing Eliza lets you personalize it. Instead of having the program answer "Do computers worry you?" any time the word computer is mentioned, you could make Eliza tell your daughter, "If you spent more time programming, you might learn something about computers." Grumette said that personalization is especially effective at parties.

Eliza's responses to your comments range from noncommittal ("Please go on") to probing ("Is that the real reason?"). The program includes many instructions to pick up words from previous statements ("Earlier you said you were lonely").

Eliza is not grammatically perfect, however. It has problems with pronouns ("How long have you been writing a review of I?"), and its inability to understand what is being said often results in gibberish (in response to "I do not like you," Eliza wrote, "Do you wish to do not like me?").

Talking to Eliza

Eliza works best in the human areas of feelings and beliefs. The program, however, cannot give information or answer questions—it often parries a question with "Why do you ask?"

In a recent interview, Weizenbaum said he wrote Eliza as a parody of a Rogerian therapist, a nondirective, client-centered therapist who does not tell the patient what to do but responds to the feelings behind what the patient is saying. "The Rogerian psychotherapist," Weizenbaum asserts, "is relatively easy to imitate because much of the therapist's technique consists of drawing his patient out by reflecting the patient's state-

Eliza Spin-offs: Terry and Abuse

Eliza is not the only good interactive English-speaking program on the market. Two others, in some ways very different and in some ways similar, use key words and random responses to comment on what you type in.

Terry, an Atari program, is a direct spin-off of Eliza, right down to the opening sentence: "Hi, I'm Terry. I'm sitting in for Eliza. What's your problem?"

Terry, however, has much more personality than Eliza. Terry's repertoire includes comments like "Do you know I can have you committed?" and "Now I know why you wanted to see an analyst." On the other hand, Terry is somewhat less likely than Eliza to pick up on key words and use them in sentences. Terry's smart-aleck approach makes the program seem more like a game and less like unsophisticated therapy.

The other Eliza-like program we discovered is Abuse. As the instructions put it, "You insult Abuse and Abuse insults you."

Instead of trading conversation, with Abuse you trade put-downs. Abuse's list is long and mostly clever: "Are you conscious?" or "May you annoy Anita Bryant" or "May a donut salesman run over your glasses."

Abuse seems to have very few key words, at least compared to Eliza and Terry, but the ones that you hit are pleasant surprises. Mention the word mother, and Abuse answers, "Don't talk about Sylvia Atari" (at least in the Atari version).

Abuse also has a game option in which you not only trade insults with the program, but you try to use secret words for which you get points. Scoring adds a little fun to the game but not as much as you'd like. The most fun in Abuse is seeing what the computer comes up with.

Abuse has one aspect that we found to be in poor taste. The program's list of secret words includes most four-letter words, which has the effect of rewarding you for mindless expletives rather than clever repartee. For this reason we say thumbs down on Abuse in any home where such language is not acceptable or in any home where children might play the game—there's no need to teach kids that swearing at the computer is okay.

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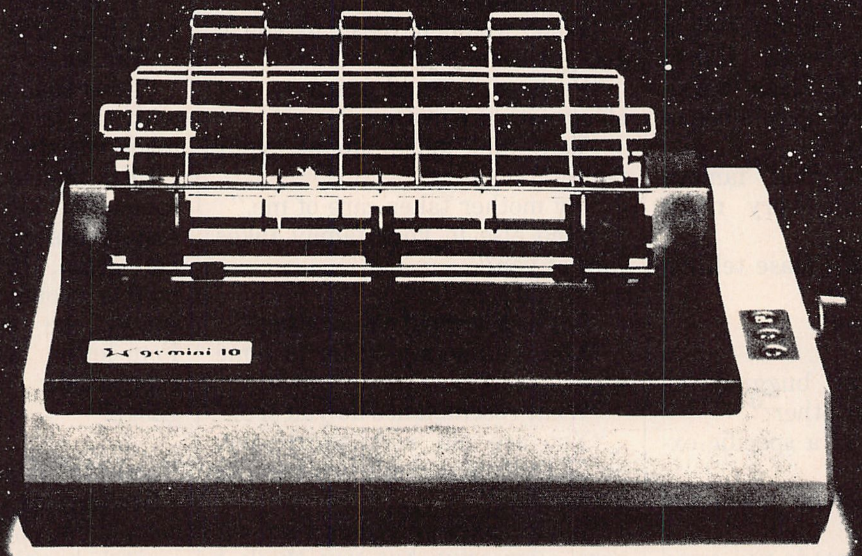

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ments and feelings back to him."

Weizenbaum said he named Eliza after Eliza Doolittle, the heroine of George Bernard Shaw's *Pygmalion* and later of *My Fair Lady*. But more like Dr. Frankenstein's creation than Professor Henry Higgins's protégée, Eliza developed a life of its own. People began to see it as therapy.

Certainly Eliza's most famous conversation sounds very much like therapy:

"How do you do? Please tell me your problem."

"Men are all alike."

"In what way?"

"They're always bugging us about something or other."

"Can you think of a specific example?"

"Well, my boyfriend made me come here."

"Your boyfriend made you come here—that's interesting."

"He says I'm depressed much of the time."

"I am sorry to hear you are depressed."

"It's true. I am unhappy."

"Do you think coming here will help you not to be unhappy?"

"I need some help, that much seems certain."

"What would it mean to you if you got some help?"

"Perhaps I could learn to get along with my mother."

"Tell me more about your family."

"My mother takes care of me."

"Who else in your family takes care of you?"

"My father."

"Let's talk about your father."

"You are like my father in some ways."

"What resemblance do you see?"

"You are not very aggressive, but I think you don't want me to notice that."

"What makes you think I am not very aggressive but you think I don't want you to notice that?"

"You don't argue with me."

"Why do you think I don't argue with you?"

"You are afraid of me."

"Does it please you to believe I am afraid of you?"

"My father is afraid of everybody."

"What else comes to mind when you think of your father?"

"Bullies."

"Does that have anything to do with the fact that your boyfriend made you come here?"

Eliza makes random comments, sometimes incorporating previous statements whenever a key word is not given. Key words (such as mother, computer, depressed, or sorry) cue specific statements. Four-letter words bring gentle reprimands: "My, my, such language!"

But Is It Therapy?

In the years following Eliza's development, professionals in the mental health field debated its meaning. Some hailed it as the prototype of a program that could eventually relieve the shortage of trained psychotherapists. Dr. Carl Sagan of *Cosmos* fame wrote:

At a Glance

Name:	Eliza	Terry	Abuse
Type	Interactive natural-language game	Interactive natural-language game	Interactive insult game
Manufacturer	Artificial Intelligence Research Group 921 North LaJolla Ave. Los Angeles, CA 90046 (213) 656-7368	Atari Program Exchange POB 3705 3281 Scott Blvd. Santa Clara, CA 95055 (800) 538-1862 (800) 672-1850 (in California)	Don't Ask Computer Software 2265 Westwood Blvd., B-150 Los Angeles, CA 90064 (213) 397-8811
Price	$45 including source file $25 protected version	$15.95	$19.95
Format	5¼- and 8-inch floppy disks	5¼-inch floppy disk, cassette	5¼-inch floppy disk
Computer	Apple II, IIe, and III; IBM Personal Computer; Osborne 1 and other CP/M-based computers	Atari 400 and 800 with 32K-byte random-access memory	Apple II and IIe with 48K-byte random-access memory; Atari 400 and 800 with 40K-byte random-access memory
Documentation	Six-page manual	Five-page manual	Two-page pamphlet
Audience	Home-computer users who want to show off their machines; students interested in classic artificial-intelligence programs	Home-computer users who want to show off their machines	Home-computer users who want to insult their machines

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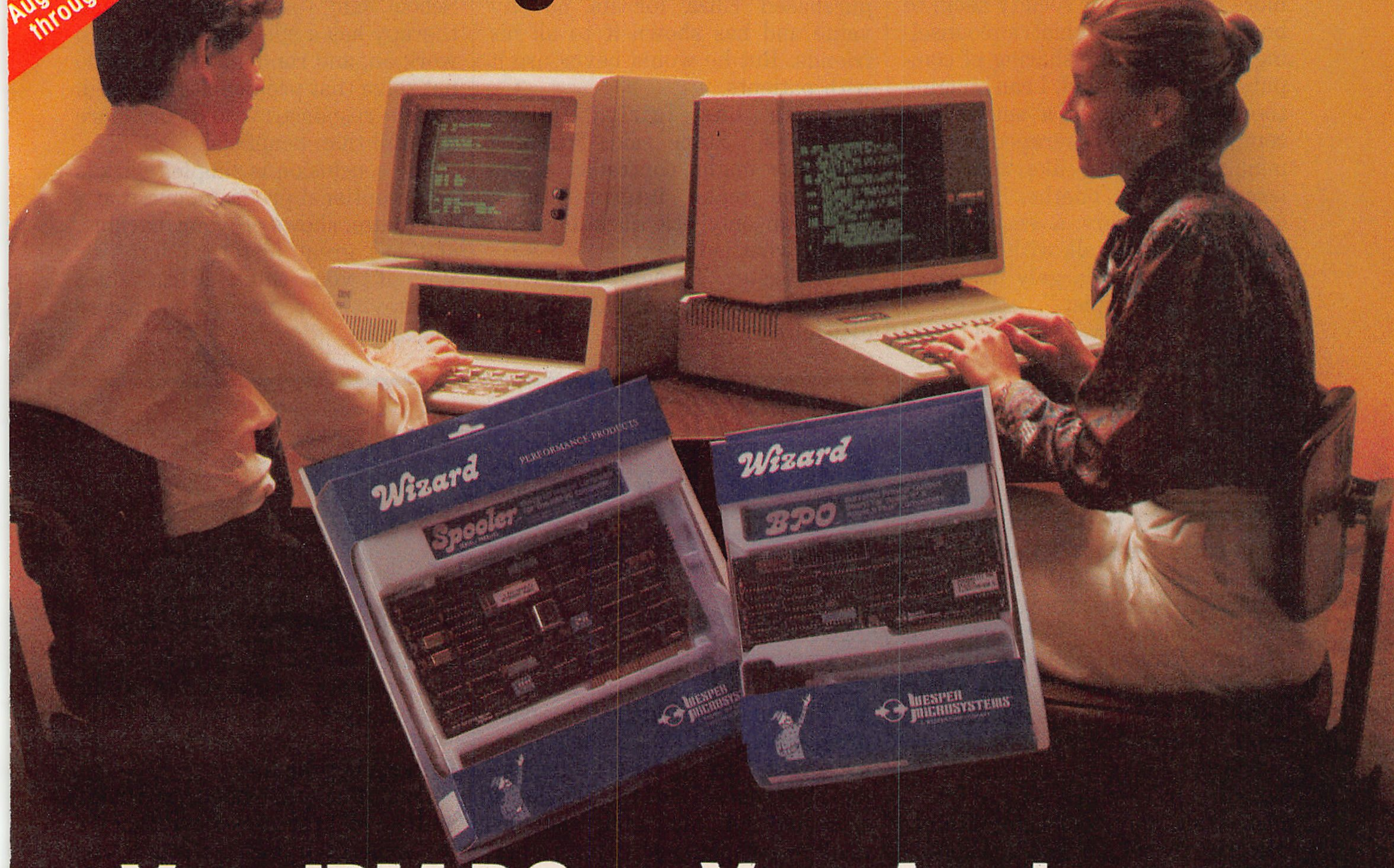

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"In a period when more and more people in our society seem to be in need of psychiatric counseling, and when timesharing of computers is widespread, I can imagine the development of a network of computer psychotherapeutic terminals, something like arrays of large telephone booths, in which, for a few dollars a session, we would be able to talk with an attentive, tested, and largely nondirective psychotherapist."

Weizenbaum was startled and somewhat chagrined by Eliza's reception. In an interview from his office at MIT, Weizenbaum said he had "rejected that child of mine."

"With the personal computer version, unfortunately, Eliza is emerging as a new debutante, and I am sorry for that," Weizenbaum added. He suggested that anyone interested in his views on Eliza read his book *Computer Power and Human Reason—From Judgment to Calculation* (W.H. Freeman, 1976) in which he explored his disenchantment with Eliza.

Weizenbaum wrote 300 pages debunking the idea that "the simplest mechanical parody of a single interviewing technique (could) capture anything of the essence of a human encounter."

Most therapists today agree with Weizenbaum. Carl Rogers, the father of Rogerian therapy, said although he had never seen Eliza he was convinced it could not possibly do therapy.

"Real therapy takes place only where there is a real relationship between two real people," Rogers asserted. Rogers also said that a few years after Eliza was developed, Weizenbaum wrote to him to say that he was appalled at the program being taken so seriously.

Yet the mystique persists. A guidance counselor (who asked to remain anonymous) in a Florida school system recently tried Eliza and concluded it might be useful for a first session. "A counselor could review the session to pick up important information," he said.

Dr. Paul E. Stone, a psychotherapist in Green Bay, Wisconsin, purchased Eliza for its novelty value and has shown it to all his friends. But he would never use it with patients.

"Eliza has fairly limited responses," Stone said. Where a therapist might contradict a patient or make interpretations, Eliza can only ask questions and parrot what is fed in.

Dr. Lester Turner, a psychologist in Washington, D.C. on the clinical faculty at George Washington University Medical School, said, "A person who wants therapy has a specified problem to work on, and random responses do not solve that problem." He added, "Such responses could be more harmful than beneficial."

The conclusion is simple. Eliza is an exceptional program, one that's fun to use, shows off your machine, and has great historical interest. But if you think Eliza does therapy, you need to change therapists. □

BUSINESS

Easy Project Management

Visischedule appeals to the operations engineer in all of us

by Robert Schilling Jr.

Most of us remember the space program of the 1960s as the spawning ground for a host of technological wonders. But the people responsible for managing that incredibly complex feat of timing and organization remember it as the point where project management became a science as well as an art. The space program became the most challenging testing site imaginable for CPM and PERT.

No, CPM doesn't refer to that well-known Microsoft operating system, and PERT isn't a synonym for lively. Both are abbreviations for large-project planning and control techniques. PERT (Performance Evaluation and Review Technique) and CPM (Critical Path Method) are two ways of breaking complex projects into a series of smaller tasks and evaluating the timing relationship between the tasks. Using these methods, a project manager can identify the jobs that lie on the "critical path," those jobs critical to the timing of the overall project. The same techniques enable a manager to predict the effects of delays in completing a job, to balance manpower usage, and to monitor the status of the total project.

Enter Visischedule

Computerized models of PERT and CPM processes have existed for some time on mainframes and large minicomputers. Projects monitored by these machines are usually awesome in size and complexity. But during the past year or so, alternatives have appeared on microcomputers for those of us with more mundane goals like managing moderately sized construction projects, sales or advertising campaigns, research programs, branch expansions, or whatever.

Visischedule, a project-management program from Visicorp (the Visicalc company) for the Apple II, Apple III, and IBM Personal Computer, is a case in point. If your project can be divided into subsets of up to 160 tasks (up to 300 tasks on an Apple III), then Visischedule may be a welcome assistant.

Visischedule is an automatic project-scheduling and job-costing

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Robert Schilling Jr. is general manager of Northeast Computer Stores in Woburn, Massachusetts.

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program. It has four primary functions. First, it provides an easy-to-use format for collecting basic data about your project. By using this format, you're gently forced to do some structured thinking about the project's various elements, namely, manpower and salary requirements, work week and nonwork periods, and the sequence of steps in the project and their duration.

Second, as you enter these components, Visischedule computes their influence on each other using techniques from PERT and CPM. The program displays the results on a chart that plots each job against the project's time line. Special markers indicate tasks that are part of the project's critical path.

Third, as you enter each job, Visischedule computes the manpower and direct costs associated with the project. And finally, the program provides a variety of report-printing options, including a summary report, a task description report, a tabular job report, and a chart or graph like the one described above (the program uses standard text characters—you won't need a graphics printer).

As you've probably noticed, Visischedule isn't a program designed to grace the shelves of the casual computer user's den. Visischedule is aimed at the professional whose job includes managing medium-sized projects. In addition to applying CPM and PERT techniques to project control, Visischedule helps answer what-if and associated questions managers frequently encounter. What happens to our advertising schedule if the new whiz-bang mouse trap isn't ready for three weeks? How can I modify the schedule to level my manpower requirements without altering target dates? Will I need to reschedule the roofing crew if we pour the foundation a week early? Each scenario can be printed for thorough off-screen analysis.

Sample Time Chart

Visischedule's time chart shows at a glance the allotted time available for each job in a project. Repairing the broken water main on First Street, as we see in this example, requires completing 10 separate jobs by specific deadlines over a 10-week period.

```
Repair First Street Water Main

Job Description               Jan            Feb             Mar
                              5   12  26  2   9   16  23  2   9   16  23
                              0   1   2   3   4   5   6   7   8   9   10
  1 PURCHASE PIPE             0------>..>     .   .   .   .   .   .   .
  2 DIG 1ST PART OF TRENCH    0------>..>     .   .   .   .   .   .   .
  3 PURCHASE FITTINGS         0=========>     .   .   .   .   .   .   .
  4 LAY 1ST PART OF PIPE      .   .   !   >======>    .   .   .   .   .
  5 DIG 2ND PART OF TRENCH    .   .   >.....  >-->    .   .   .   .   .

  6 FILL 1ST PART OF TRENCH   .   .   !   .   .   >-->..>     .   .   .
  7 LAY 2ND PART OF TRENCH    .   .   !   .   .   >=====>     .   .   .
  8 FILL 2ND PART OF TRENCH   .   .   !   .   .   .   .   >==>    .   .
  9 REPAVE STREET             .   .   !   .   .   .   .   .   >=====>
 10 REPAIR SIDEWALK           .   .   !   .   .   .   >-->......+..>

 11 PROJECT COMPLETED         .   .   !   .   .   .   .   .   .   .   X
```

Symbol	Explanation
>-->	Duration of a normal job
>..>	Slack time for a normal job
>==>	Duration of a critical-path job
>::>	Duration of a completed job
*	Job with zero duration
+	Job deadline
0-->	Job with no prerequisites
>--X	Job with no successors
!	Time break due to holiday or week off

Using Visischedule

The Visischedule package includes the program disk, an example disk, and an excellent manual which is divided into three sections: a program introduction, a four-part tutorial, and a comprehensive reference section.

I found Visischedule very straightforward and easy to use. The screen display is divided into two sections: a 20-line work area beginning at the top of the screen and a 4-line menu and prompt area at the bottom. Menu selections control activity in the work area and movement from one section of the program to another. You enter all data on a prompt line at the bottom of the screen before the program transfers the information to the work area. This procedure, which is similar to the one used in Visicalc, lets the program check entries for obvious errors or inconsistencies.

The first few steps of the program gather basic project data and parameters such as start date, time base (days or weeks), currency being used, and currency multiplier for manpower and direct costs (units, thousands, or millions). At this point you can manually set the project revision number, which the program automatically increments each time you access the schedule. Next you enter up to nine project job titles and salaries. And finally, depending on whether you selected a daily or weekly time base, you enter nonworking days or weeks. Now you're ready to move to the schedule display where most of the program's operation takes place.

A project schedule, like the one in our sample schedule, appears on the screen as a movable window à la Visicalc. If the schedule is larger than the display screen, you can

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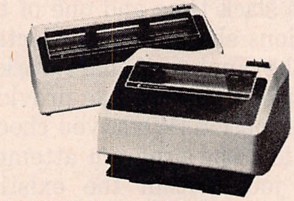

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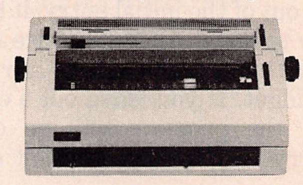

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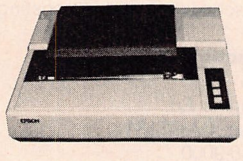

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scroll the window across or down the schedule. The display consists of two sections: the left contains the job descriptions, and the right contains the time-line schedule.

The next step, adding tasks to the schedule, requires that you break the project into its component operations. Although the program provides a variety of options that let you move or insert tasks left out of the initial entry, it has no way to know what steps are necessary to build a bridge or advertise a widget. If you leave out a crucial job, the program will go on its merry way totally ignorant of the fact.

Visischedule provides a quick visual assessment of all phases in a complex project.

However, the program does help where it can. When entering a job, you are asked to provide essential data such as its duration, prerequisites, earliest finish date, direct costs, and deadline (if any). You must also specify the number of individuals from each occupation you'll need to complete the job. These questions often help you identify tasks missed in the planning phase.

As you enter each task, Visischedule evaluates the data and plots the job on the schedule. Symbols describe each job. A double-dashed line (>========>), for example, indicates a critical job, while a single-dashed line (>--------->) plots a noncritical job. Noncritical jobs often have slack time, shown by a dotted line (>......>). In this way, Visischedule provides a quick visual assessment of the status of all phases of a complex project.

As you enter additional jobs, it's quite possible that you'll revise earlier tasks and give them a different status. In other words, a task might become a critical prerequisite for a new job or pick up slack time as a result of a new job's start date. The program has additional symbols that designate deadlines, milestones, and jobs with no pre- or postrequisites.

The Fun Begins

After you've entered the schedule, the real fun begins. You can move or renumber jobs, alter starting dates, and display manpower and direct costs. If the schedule contains slack time and one of the occupations shows a lot of fluctuation in the number of hours worked each period, Visischedule provides a "level" option. When you choose this option, the program attempts to slip jobs within the existing slack time to balance the designated job's number of hours per period. It's up to you to review the remaining jobs to ensure that this leveling hasn't overloaded another position.

At a Glance

Name: Visischedule

Type
Project scheduling and job costing

Manufacturer
Visicorp
2895 Zanker Rd.
San Jose, CA 95134
(408) 946-9000

Price
$300

Format
5¼-inch floppy disks

Computer
Apple II and IIe with 48K bytes of RAM (random-access memory) and one disk drive; Apple III with 128K bytes of RAM and one disk drive; IBM Personal Computer with 64K bytes of RAM and two disk drives

Documentation
Manual with complete tutorial and reference section; example disk with sample files

Audience
Those responsible for planning and overseeing moderately sized projects

At this point you also get to play with what-if questions. After you save the schedule you think is best and print a reference copy to compare against alternate schedules, you're ready to go exploring. What if it rains and you can't lay the foundation for a week? To find out, simply change the finish date for the foundation by a week, and watch Visischedule automatically adjust the timing of any job that depends on this date. You can even print this version to explore the effects in detail later and save this change as a second file for recall later.

Pros and Cons

A program of this complexity, particularly when run on microcomputers with limited memory and disk space, has to make some compromises. On the Apple II, I found two troublesome areas that didn't seem consistent with the program's ability to handle projects with 160 tasks. Because you're limited to entering only nine occupations at a time, you might have to pass up the job-costing aspect of the program or break the project into smaller sets of schedules with different manpower lists.

In a similar vein, you're required to enter costs as 1- to 4-figure integers with multipliers of either a thousand or million. To highlight the potential problem, let's take a project with 40 tasks. Costs for 35 of these tasks range from $500 to $800. Five of the jobs cost between $12,000 and $20,000. Because you must enter the costs as 4-figure integers, you're forced to either ignore one of these two groups or under- or overestimate one group.

The 35 jobs rounded up to $1000, with an average error of $350, produces a $12,500 overestimate. Five jobs rounded down to $9999, with an average error of $6000, produces an estimate $30,000 short. It's obvious why job costing is not one of Visischedule's strengths.

On the plus side, Visischedule is

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easy to use. My last experience with CPM and PERT was a long-forgotten college course. Yet I was able to learn the program and produce a simple but very helpful project schedule in a single evening. The program works smoothly, and the printed reports were everything I could have possibly used, and then some.

Visischedule includes a fair amount of artistry as well. Dates, a major part of a scheduling program, are a good example. Not only are dates verified for accuracy (you simply can't enter February 30, nor can you enter a deadline earlier than a starting date), but you can enter dates in a host of convenient ways. Need to add five weeks to a date? Just type +5W, and the program calculates the correct date. Days, months, and years work the same way. A minus sign, as you might suspect, subtracts those same units. Need to change a date? To change 5/15/82 to 7/15/82, just type 7; to change 6/25/81 to 6/25/82, type a simple //82. Small points? Sure they are, but only to someone who doesn't have to do them daily as part of their job.

Finally, Visischedule, like all the products in the Visicorp line, has the ability to transfer some of its data to compatible programs by using DIF (Data Interchange Format) files. These files can be read by other Visicorp programs, including Visicalc, Visifile, and other packages that have provisions for reading DIF text files. After using Visischedule, you could use Visicalc, for example, to do further analysis of the manpower and cost figures without retyping the data into the Visicalc program.

My overall impression of Visischedule was very favorable. The program is easy to learn, beautifully documented, and does with style what it purports to do. I believe $300 is a reasonable price for the value offered. While Visischedule isn't going to be everyone's cup of tea, it will surely be welcomed by all those whose responsibilities include project management. □

WORD PROCESSING

Scripsit Made Super?

Radio Shack's Superscripsit is a very dependable word processor but falls short of superstar status

by John Edwards

Since its debut more than five years ago, Radio Shack's Scripsit has been the best-selling word processor for TRS-80 computers. Boasting easy-to-understand commands and a relatively inexpensive price tag, it's a program other companies have tried to imitate but few have equaled. Yet time has taken its toll on Scripsit, which was originally designed for the TRS-80 Model I and dinosaur-era printers. Radio Shack could have continued making minor improvements to its workhorse word processor, but the company felt a major revamping was in order; hence the release of Superscripsit. Although some of Scripsit's features were dropped, Superscripsit works much like the original program and incorporates some noteworthy additions, including:

- proportional-spaced printing
- underline, double underline, boldface, superscripts, and subscripts
- proofreading program
- 10 user-defined keys—one keystroke calls forth frequently used words and phrases (up to 127 characters)

To run Superscripsit on your TRS-80 Model I or III, you'll need a computer with at least 48K bytes of RAM (random-access memory), one disk drive (a pair of drives for the Model I), and a printer. Although the program's documentation mentions only Radio Shack printers, Superscripsit does run on most popular brands of dot-matrix and daisy-wheel printers. However, some Superscripsit functions such as proportional spacing and underlining are possible only on certain brands of printers. The company that manufactures your printer can probably tell you which Superscripsit functions will work on its product.

Topnotch Text Editor

One of Scripsit's major selling points was the easy way it handled text, and fortunately, this asset has been faithfully transferred to its successor. After selecting the Open Document option on Superscripsit's main menu, you're prompted to give the document a name of up to eight characters. At this point Superscripsit, unlike its predecessor, lets you define the number of lines per page (54 is the default setting), pitch (number of printed characters per inch), line spacing (up to 3½ line spaces between lines of text, specified in half-line increments), and header and footer instructions.

Moreover, Superscripsit runs rings around Scripsit when it comes to manipulating blocks of text. The Freeze command lets you safeguard a block so you can't accidentally erase it. The program even has an Unfreeze command that lets you "defrost" protected sections for further text editing. Another novel command changes line spacing within a text block you want to move. And the Adjust command lets you create what's called a "model paragraph" so that margin indents, pitch changes, and other parameters within a document can be implemented swiftly.

By typing Ctrl-U from any open document, Superscripsit users can access one of the program's most powerful features—the user-key function. User keys (the 10 number keys at the top of the keyboard) are

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John Edwards is a contributing editor of *Popular Computing* who lives in Queens, New York.

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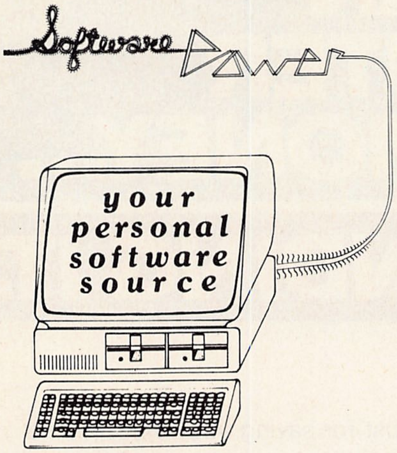

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extremely handy for storing keystroke sequences you use often.

Two steps activate the user keys. First, you select from a menu the key to be programmed. Next, you type the sequence of keystrokes you want the key to represent. Immediately, the key is ready to execute its task. All you have to do is press Ctrl and the user key.

Print Options and Proofing

Superscripsit's enhanced printing and proofreading features are ample proof that the new program is much more than Son of Scripsit. Underlining, double underlining, and boldface printing are all accessed through printer toggle codes. As the documentation explains, a toggle is simply an on/off switch. The first time a toggle code occurs, it turns on the print function; the second time, it turns off the function. For example, to toggle the underline function, you press Clear and the dash key before and after the text you want underlined. On the screen, you see dashes at the beginning and end of the underlined portion of the text. Likewise, if you want to double underline a portion of text, you press Clear and the equal-sign key. On the monitor, equal signs appear on either side of the designated portion of text. You use a similar procedure for the boldface command.

While not invoked by toggle codes, superscripts and subscripts are just as easy to add to any document. To insert a superscript code, you press Clear and an asterisk. When the printer spots this code, it uses reverse feed to print a half-line higher. To cancel the superscript code, you type Clear and a period to get back to the normal line. For subscripts you reverse the codes—first period, then asterisk.

Superscripsit's proofreading option is probably its most intriguing addition. It's a separate, self-contained disk program that interfaces with the Scripsit Spelling Dictionary (a Radio Shack software package that retails for $149) to provide a spelling checker. Requiring a minimum of two disk drives (three drives for the Model I), the Proofread feature works by comparing Superscripsit text against the entries in the 75,000-word dictionary disk. You get the spelling checker rolling merely by selecting P on the main menu. After scanning the text, the program displays the number of words processed and the total number of words not found (presumably misspelled). At this point you can look through the document, spot each mistake (flagged with a cursor), and either skip, automatically correct, or add the word to the dictionary.

Five-Star Documentation

With Superscripsit, Radio Shack continues its fine tradition of supplying customers with some of the most readable software documentation in the microcomputer industry. The software comes packaged in a vinyl binder that holds two sets of printed instructions: the Superscripsit reference manual and a booklet of illustrations and charts. Both manuals are well designed and easy to read. Because the reference manual comes with its own spiral binding, you can snap it out of the binder and use it on its own.

Like Scripsit, Superscripsit comes with four audio cassettes that take you through a step-by-step instruction course in Superscripsit basics. The cassettes, while professionally produced and easy to follow, mainly complement rather than supplement the written documentation. While most purchasers will find the cassettes a pleasure, seasoned Scripsit users may find the lessons a trifle tedious and redundant. Still, it's always better to have too much documentation than too little.

For on-the-spot reference, Superscripsit also provides a third level of documentation within the software itself. By consulting one of the help screens (available from nearly any level of the program), users get answers to many system

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questions within a few seconds. Consisting of seven independent screens, the help pages provide information on topics such as opening and closing documents, setting tab values, and text editing. Advanced users can delete the help screens from the program disk to make more room for document storage.

Yet even superb documentation is of limited value when the software it explains has been rushed onto the market. Like many companies in the frenetic computer industry, Radio Shack committed itself to a release date for Superscripsit that curtailed testing time. With the 1983 Radio Shack catalog touting the program's availability, the package was flung to an unsuspecting public before all its ills could be diagnosed and cured. The result, in hacker's vernacular, was a program residing in "Bug City."

A couple of the major bugs in the first Superscripsit release (the minor ones are too numerous to catalog) were truly mind-boggling. For instance, if you tried to move a block of text, you stood about a fifty-fifty chance of having the program crash back to the TRSDOS Ready stage and losing your text. The program also had a nasty tendency to lose data while supposedly storing it on a disk.

According to Radio Shack, all these bugs are history now. If you were unlucky enough to purchase a copy of Superscripsit that predates Version 1.1.0, you can swap it for a debugged version at your Radio Shack store.

That Ol' Shack Magic

Although the cleaned-up version of Superscripsit is a very good word processor, it reminds me of the New York Yankees without Goose Gossage: good, but not as terrific as it could be. While proportional spacing and superscripts and subscripts are nifty enhancements, Superscripsit completely cops out when it comes to graphics. Neither the Model I nor III is

At a Glance

Name: Superscripsit

Type
Word-processing program

Manufacturer
Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3011

Price
$199

Format
5¼-inch floppy disk

Computer
TRS-80 Models I and III

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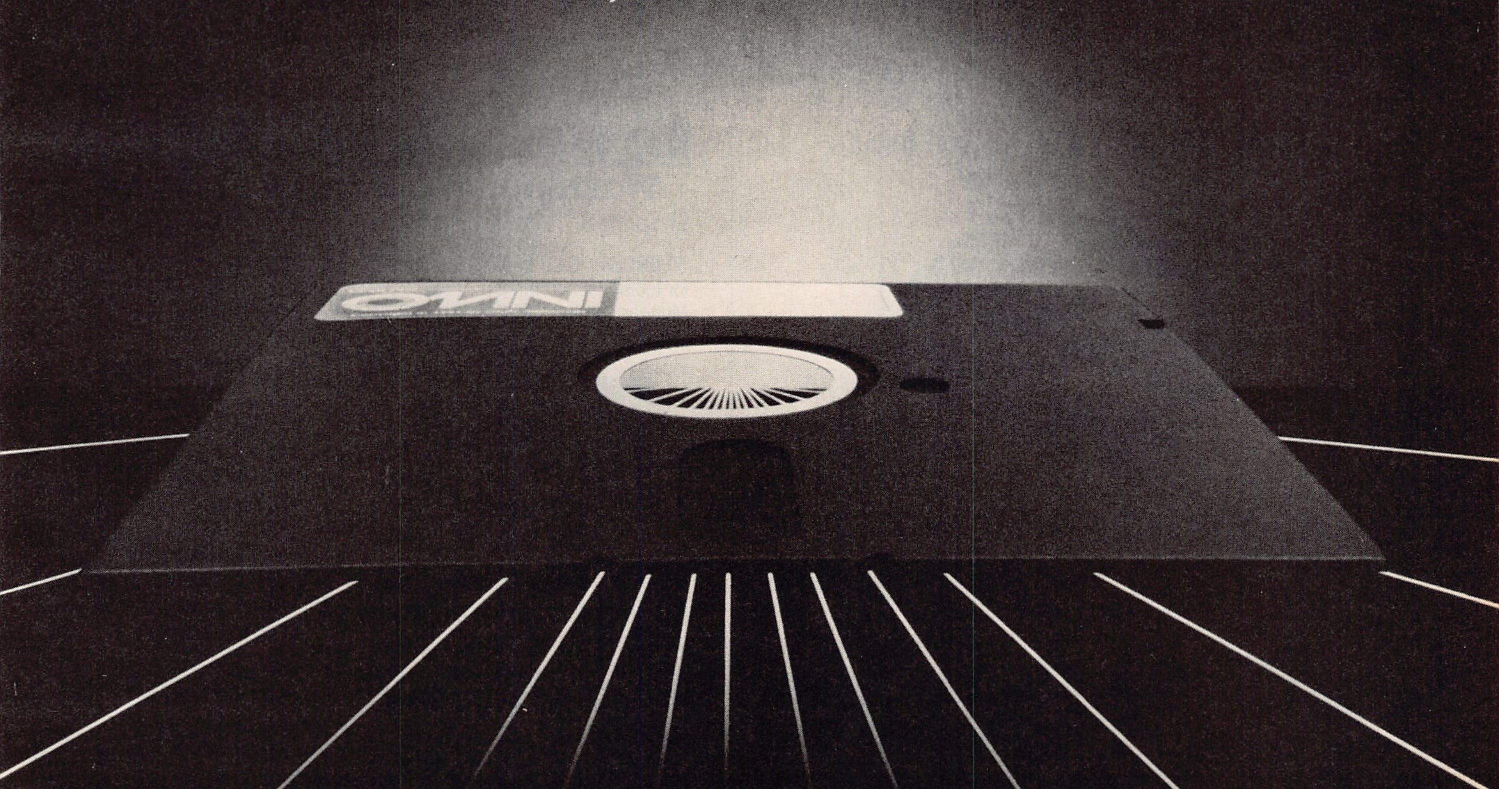

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noted for its graphics capabilities, to be sure, but Superscripsit won't even support TRS-80 block graphics. Many printers (such as those from Okidata) have a complete onboard TRS-80 graphics character set, and many Scripsit competitors began supporting graphics a long time ago. It's a shame that Radio Shack doesn't support all the functions of its own hardware, because that means that users who want fancy letterhead and business charts won't be buying Superscripsit.

To extend the baseball metaphor, Superscripsit is a solid .285 hitter—very steady and workmanlike. If a straightforward, easy-to-master text editor is what you're looking for, Superscripsit at $199 is one of the best buys on the market. It has the same "ol' Shack magic" that made Scripsit such a best-seller. Maybe some day that magic will extend to graphics. □

GAMES

Flight Simulation

Fly a twin-prop plane in your home

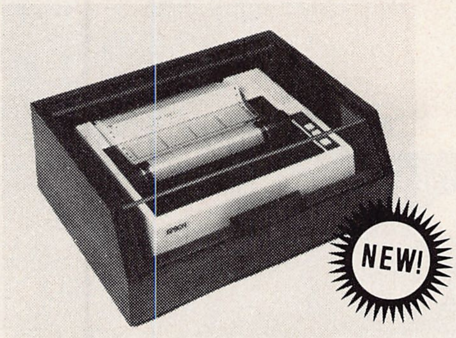
by Robert J. Nielsen

Beginning perhaps with the legendary Daedalus and Icarus who flew with mixed results using wings of feathers and wax, flying has always captured man's imagination. Growing up, I never escaped its lure either. A builder of model rockets and radio-controlled airplanes, I was interested in anything that flew. Even as a graduate student I was ecstatic at visiting and "flying" a simulator for the F-4 jet at a local Air Force base. Thus, it was with a great deal of pleasure that I received the Sinclair Flight Simulation software.

The word "simulation" in the name of the program is well chosen. The software is a cousin to a real simulator, a full-scale mock-up of a cockpit whose controls operate just as a real aircraft's do. While Flight Simulation differs in several ways from a simulator, this program is definitely not a game—not a competition or contest where realism takes a back seat to playability. This is not to say that you can't make a game out of the program, just as real pilots use real aircraft in contests and competitions. Nonetheless, what Flight Simulation does best is simulate the navigation and flying of a twin-

Robert J. Nielsen works at the American Embassy in Algiers.

Epson, OKI, IDS, NEC, Diablo, Qume



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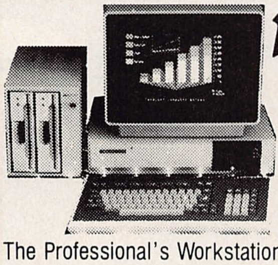

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engine propeller airplane.

In Flight Simulation the pilot controls turning, climbing, and diving and operates the throttle, flaps, and landing gear. Instruments in the cockpit show the rate of climb (or descent), compass direction, engine speed, landing gear position, fuel level, position of the flaps, altitude above sea level, and speed.

If you fly the plane too slowly or lower the flaps or landing gear at too fast a speed, the plane stalls and crashes—a nice touch of realism.

From the Pilot's Seat

Looking out the window, you see the ground (represented by black) meet the sky (represented by gray), which is by definition the horizon. The horizon changes position as the plane banks, climbs, and dives. Except for the landing sequence, the ground remains a featureless black, so unfortunately you get no sense of the ground moving under the airplane.

Flying itself, however, is handled accurately and in great detail. Lowering the landing gear, for example, causes the plane to slow down slightly because of the extra air resistance. Also, all other things being equal, climbing subtracts speed while diving increases it. If you let the plane fly slower than about 90 nautical miles per hour, it goes into a stall and crashes into the ground. You'll also crash if you lower the flaps or landing gear at too fast a speed, thus causing structural damage to the plane. All these aspects add a pleasant degree of realism.

One real-life problem—entering a vicious cycle of correction/overcorrection—invariably occurs when you're flying the simulated plane. For example, in approaching the runway you may find yourself descending too quickly. You try to compensate and suddenly find yourself climbing away from the runway, at which point you dive again until you are diving too steeply, thus initiating the whole correction/overcorrection cycle again. Just as in real flying, it takes practice to avoid this error.

Not all aspects of the program are true to life. In one dive, for instance, I reached 716 nautical miles per hour, some 47 miles per hour faster than the speed of sound. This speed should not be possible except for jet aircraft designed for supersonic flight. In most normal flying on the Sinclair you won't exceed 300 miles per hour, so you'll probably avoid this unrealistic aspect. (In my case I had to climb to 25,000 feet and then dive as steeply as possible into the ground to exceed the speed of sound.) Also, if you want to do barrel rolls or loops, be warned that such maneuvers are not possible—the closest the program allows are steep turns, climbs, or dives.

Navigation is one important aspect of flying that is well represented in the Flight Simulation program. Six strategically placed radio beacons aid the pilot in calculating the plane's location. You merely choose which beacon you are tuned in to, whereupon instruments show the distance to the beacon, the compass direction to the beacon, and the compass direction of the beacon relative to the plane's direction of flight. If the mathematics of beacon bearings and distances are too much (I now see why one of the first applications for pocket computers was for light aircraft), press the M key on the Sinclair to see a map that shows the location of the airplane, runway, beacons, and an important escarpment near the airport.

I should say the program is supposed to show you the map when you press the M key. Quite often I had to press the M key two or three times before the program would display the map. Some of the keys for other functions proved at times to be just as difficult. This quirk can be a real problem when you need to do something in a hurry. Unless you want to say that fumbling with keys simulates groping around for a map in the cockpit, you have to chalk it up as a drawback to the program.

If you navigate correctly (or let the program place you at the beginning), you approach the runway from the right direction for a landing. At this point, you shift to the visual mode, which shows the runway in proper perspective, moving as you approach it. Additionally, the program displays key instruments to help you land, including an Instrument Landing System that guides you to the correct angle of approach.

Approaching the runway is perhaps the most satisfying part of the simulation: you feel as if you're really bringing in a plane for a landing. Moreover, you have to be on your toes every second, doing just the right thing at the right time to land safely. On the first few attempts at landing you invariably overshoot the runway or end in a crash; other times you hit the runway too hard only to bounce back into the air. If you somehow manage to land the plane gently on the runway, you shut the engine down and slow to a stop (the computer seems to apply the plane's brakes automatically).

Once safely landed and stopped, you receive uncannily appropriate comments on your landing. On the other hand, should you crash, a display of graphics shows the windshield and control panel disintegrating, making you feel as if you had actually crashed. Then the program tells you the reason for your crash and asks if you want to try once more.

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Another option—wind—can spice up the simulation. At the beginning of the program you can choose to have wind, which is given a direction and a strength. The wind complicates navigation because it usually blows you off course. It makes landing doubly difficult because it causes your plane to drift as you make the final approach. As if you weren't already busy enough controlling the flaps, landing gear, air speed, and altitude, you now have to fight to keep the plane heading in the correct direction.

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Editor's Note: A similar but more sophisticated flight simulation program is available from Microsoft for the IBM Personal Computer. Microsoft's program, Flight Simulator ($50), offers real-time graphics and sound, a game mode called British Ace, as well as a number of other advanced features. For further information, write to Microsoft Corporation, 10700 Northup Way, Bellevue, WA 98004; (206) 828-8080.

At a Glance

Name: Flight Simulation

Type
Simulation of flying a light aircraft

Manufacturer
Sinclair Research Ltd.
3 Sinclair Plaza
Nashua, NH 03061
(603) 882-9534

Price
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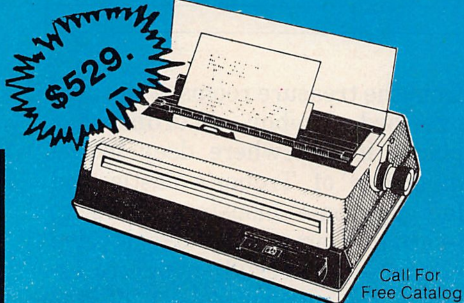

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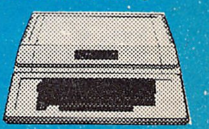

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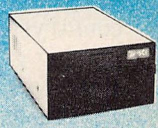

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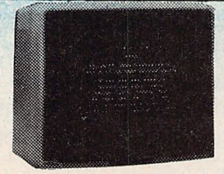

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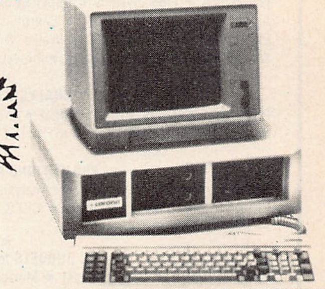

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GAMES

Adventure Games Discover Graphics

Pictures add new life to traditional role-playing games

by Jon Johansen

If you've been searching countless dungeons and thousands of miles of countryside for a new twist to role-playing games, you'll discover it in Race for Midnight and Wizardry: Proving Grounds of the Mad Overlord. Both games are terrific examples of the new wave in adventuring, where high-resolution color graphics accompany the usual text-oriented style of gaming.

While some people enjoy the zip that graphics give an adventure, others dislike them because they can be distracting. But like it or not, graphics-oriented role-playing games are now showing up in more and more new releases or in graphically enhanced versions of the nongraphic originals, such as the Scott Adams Graphic Adventure (S.A.G.A.) series. Game designers have decided graphics are a good way to generate excitement—and I agree.

The Adventure Experience

Hard-core Fighters and Wizards, take notice! "The evil wizard Werdna has stolen a valuable item from the treasure rooms of the mad overlord Trebor. Werdna has placed it somewhere deep in the dungeons of Trebor's castle and left fearsome monsters there to guard it. Your mission is to develop characters powerful enough to explore the deeper levels of the dungeon and recover the item." So starts Wizardry: Proving Grounds of the Mad Overlord, the most complete and challenging role-playing game I've ever seen.

Up to six players may participate in Wizardry although you can play by yourself. To begin you create a character from any of eight classes (fighter, priest, thief, samuri, bishop, lord, ninja, or mage), five races (human, elf, gnome, dwarf, or hobbit), and three alignments (good, neutral, or evil). You then distribute a given number of points among six characteristics (strength,

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Jon Johansen is a 14-year-old freelance writer from Houghton, Michigan.

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When you've finished outfitting your characters, it's time to test them in the maze, a rather complicated dungeon. Starting at the top of a flight of stairs, your party descends into a three-dimensional world filled with monsters, frost dragons, bushwackers, evil bishops, creeping cruds, slimes, and small humanoids. Although all of these characters or monsters are graphically represented in Wizardry, none of them actually moves on the screen. Instead, these and other items in the maze appear in a window in the upper left-hand corner of the screen.

Literally hundreds of magical items can be found at the Trading Post or at other places throughout the game. Each item may have up

At a Glance

Name: Wizardry: Proving Grounds of the Mad Overlord

Type
High-resolution role-playing game

Manufacturer
Sir-tech Software Inc.
6 Main St.
Ogdensburg, NY 13669
(315) 393-6633

Price
$49.95

Format
Double-sided 5¼-inch floppy disk

Computer
Apple II with 48K-byte random-access memory

Audience
Adventure-game players

Name: Race for Midnight

Type
High-resolution role-playing game

Manufacturer
Avant-Garde Creations
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Eugene, OR 97403
(503) 345-3043

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Format
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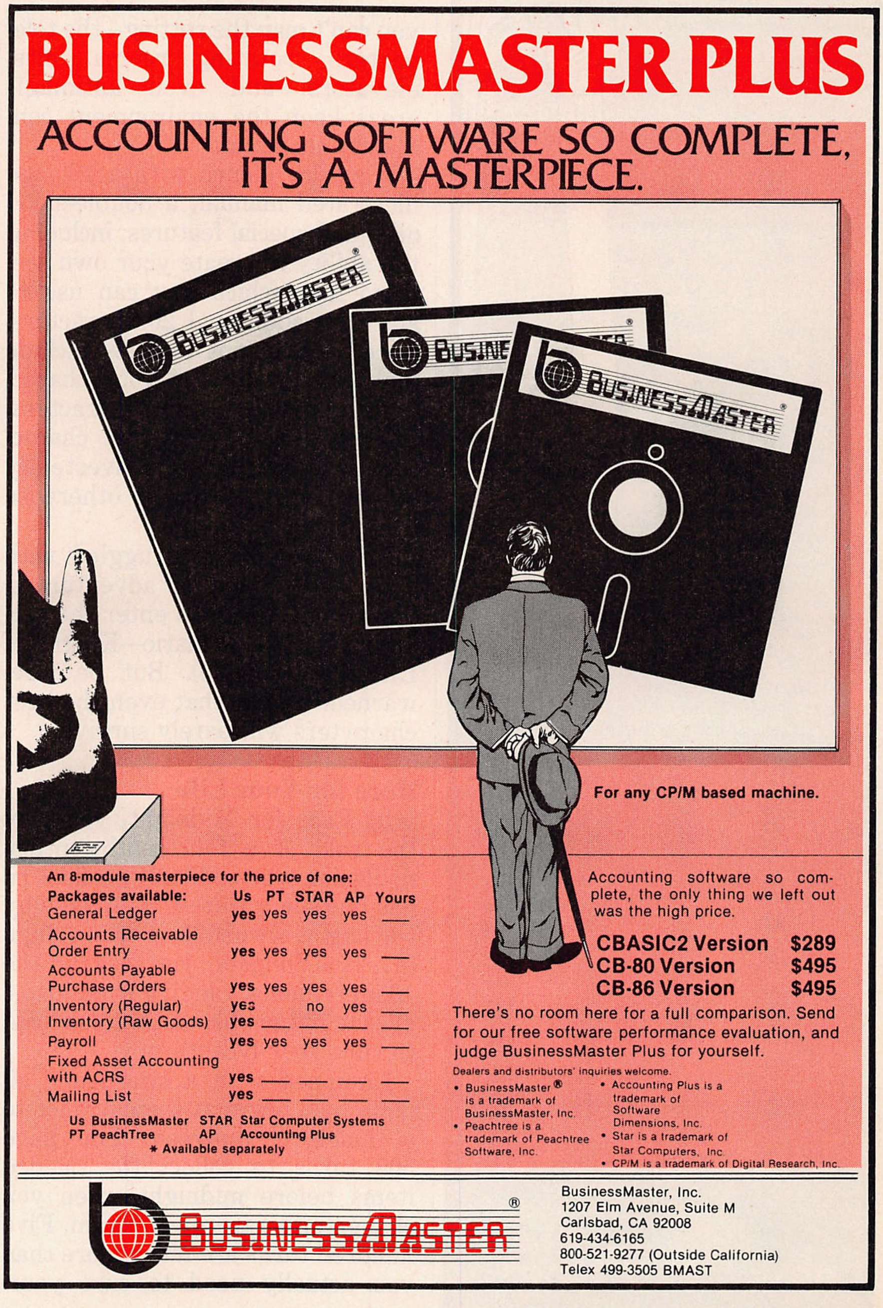
Audience
Adventure-game players



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to 100 different characteristics that color the way you can handle or use it.

In Wizardry, the rooms and pits keep changing so you can't map the dungeon.

Like the dungeons in traditional role-playing games, the Wizardry dungeon has dark areas, stairs, and secret doors. Unlike the case with other games, however, in Wizardry you can't map the setting—the teleporters, rotating rooms, pits, elevators, and even antimagic areas keep the environment constantly changing.

Wizardry comes with a 48-page illustrated manual, a double-sided disk, and special features, including the ability to create your own scenario disk which you can use to store an additional 20 characters. Other convenient utilities include making a backup of your characters, renaming your characters, and even recovering lost characters if you manage to inadvertently hit the reset button or otherwise lose power.

After you have struggled with your small band of adventurers, you will be ready to enter the second Wizardry scenario—Knight of Diamonds ($34.95). But be forewarned—I hear that even the best characters will barely survive!

Race for Your Life

In Race for Midnight, you play the role of a fourteenth-century nobleman who suddenly realizes he has become a werewolf. Driven by the angry townsfolk to take refuge in a local dungeon, you seek out the 10 ingredients, ranging from toads' eyes to dragon blood, that you need to cure your lycanthropy.

Equipped with a sword and oil lamp, you begin at the entrance to a dual-level dungeon. You have 500 turns to collect the needed items before midnight when you change into a werewolf again. Five hundred turns are much more than you actually need to cure yourself—the average completion time for the game is approximately 100 or 200 turns.

The only way to lose this game is at the hands of those malevolent meanies who inhabit the dungeon. Combat takes the form of numerical warfare: random numbers from 1 to 20 constantly appear and disappear on your screen until you press a key, which causes the most current number to be displayed. Although you need to hit the monster with the correct number only once to kill it, you have three chances to succeed. All monsters are displayed in the right-hand graphics corner, and when they're killed, the screen goes dark until they reappear, flipped sideways in agony.

You can switch back and forth between two modes of play in Race for Midnight. The first is comprised of text with the top five lines reserved for descriptions of where you are, what you see, and how to exit. Pressing the Return key brings you to the second mode, a brilliant high-resolution view of the room and any items or monsters you might find there. Although the game design boasts 75 rooms, I found that many of these are similar.

The dungeon in this game never changes, so it's fairly simple to map out. In fact, because the monsters and objects found in the dungeon never move, the game may be too simple for experienced adventurers.

Unlike Wizardry, Race for Midnight includes sound. You'll hear combat crashes and funny tunes that play when a character or monster is killed.

Although Race for Midnight is a far cry from the Scott Adams adventure series, its color graphics and sound do add a new twist to adventure gaming. ☐

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BUSINESS/HOME

List Handler

Simplified data management for the Apple II

by J. A. Love and T. C. Loder

Do terms like relational database, B-tree index, and indexed sequential access throw you off? Do you feel annoyed at having to learn principles of data structures just to set up an ordinary mailing list or file retrieval system? If you answer yes to both questions, you owe it to yourself to take a look at List Handler from Silicon Valley Systems Inc.

This $89.95 program for the Apple II and IIe gets you up and running with a minimum of advanced preparation. You needn't spend time planning your database (referred to as your "list" in this program) on paper—you can work out the filing system right on the screen. And equally important, you can change the setup even after you've entered all your data. The restructuring process is simple and painless. Getting printed reports, labels, and lists with this program is just as easy.

Couple these features with a 66-column, upper- and lowercase screen display (achieved with high-resolution graphics), prodigious disk storage capacity, the ability to share data with word-processing and other programs, and an easy-to-learn operating terminology, and you have a program that's ideal for first-time database users.

What's in the Package?

List Handler comes in a slim vinyl folder containing a 73-page users guide and three 5¼-inch disks in standard Apple DOS (disk operating system) 3.3 format. Two disks are identical; each has the List Handler program on one side and the List Utility program on the flip side. The third disk contains a tutorial program on one side and tutorial documents on the other.

List Handler and List Utility are fully menu-driven, that is, they prompt you with available options at every stage. List Utility lets you create a new list or modify an old one, copy a list onto a backup disk, or convert a list into a standard Apple text file or data interchange format (DIF) for use with Visicalc and other Visi-compatible programs.

List Handler lets you work with a specific list. You can add or delete entries; sort entries in ascending, descending, or other order; design mailing labels or reports; and print the labels or reports.

The tutorial disk, supplemented by instructions in the manual, lets you work with a sample list and form letter. Working with the tutorial for an hour or so gives you a thorough understanding of the package and is more fun than plowing through a manual on your own.

Storage Capacity

The difference between a database and an ordinary text file is that the information in a database is structured into records that are usually of uniform length but contain different information. In common terminology, you can think of a record as a file entry. The records or entries are further divided into fields; each record contains an identical number of fields. In a mailing list, for example, each record consists of a name, street address, city, state, and zip code. Each of these five components is called a field.

In List Handler, one list can con-

J. A. Love and T. C. Loder are oceanographers at the University of New Hampshire in Durham.

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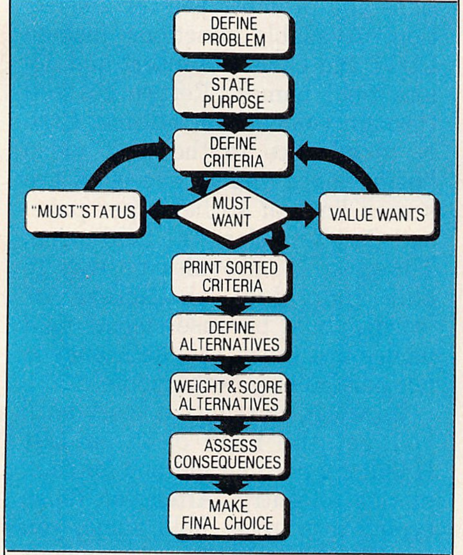

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tain up to 3000 records on a single disk. If you need to include even more records, you can extend a list onto one or more additional disks. However, you lose some of the sorting and searching capabilities by adding more disks.

The maximum record size is 4000 characters—a large number compared with other database management systems. Each record can be divided into as many as 255 distinct fields—also a relatively large amount. Maximum field size is close to 200 characters. If this size isn't adequate, you can link fields together so they appear as one when you print out the database.

List Handler's capacity for large records and its flexibility in handling fields makes the program suitable for text retrieval as well as for ordinary mailing lists and similar applications (text retrieval is the storage of word processing-type information in a database). For instance, you can use List Handler to store research notes. When you've completed the research, you can sort the notes, then print or store them in an easy-to-read format for final editing with a word-processing program.

List Handler's screen prompts are clear and concise, unlike the cryptograms you often encounter in this type of package.

Screen Display

List Handler exploits the Apple's high-resolution graphics capability to full advantage and permits software-generated upper- and lowercase characters without hardware modification. Because the Apple II's shift key does not generate the appropriate codes for upper- and lowercase letters, experienced Apple users may be wondering how to type in upper- and lowercase characters. The solution is simple albeit tedious: each time you want a capital letter, you must press and release the Escape key. A far better solution is to install the standard shift-key hardware modification, which enables you to use the keyboard like a normal typewriter. Unfortunately, the List Handler manual does not tell you about this modification.

Screen prompts and menus are clear and concise, bearing little resemblance to the cryptograms we've had to contend with when using some other database systems. Each menu option calls up a unique screen display. The manual shows each of these displays exactly as it appears on the monitor. In a tutorial fashion, the manual then uses a sample mailing list to discuss typical responses and suggest a data-entry sequence. Using the same mailing list as a guide, the manual also explains further operations such as adding or deleting records, performing a search, or printing an ordered list.

Work space on the video monitor is restricted to a variable-width portion of the screen, sandwiched between a single line of text at the top that displays your menu selection and a list of control characters and their functions arrayed across the bottom. Each time you select a new option from the main menu, the screen clears and displays another list of easy-to-remember control characters.

Creating a List

As with other database systems, with List Handler you define the records or entries in a list by naming field names that fit your particular application. Typical field names in an account-management file, for example, might include: First Name, Last Name, Address, City, State, Zip Code, Phone #, Invoice #, Status, and so on. Unlike other database systems, however, List Handler organizes your records as a simple list of field names rather than as a complex form you design when you create the list. The specific form your printed output will take is completely independent of the format the program uses for storing the records. When it comes time to print out a sorted portion of your list, you can design the output form on the spot or recall an old one from the disk. This method of file management is a significant improvement over the methods most other file managers use. Not only does it substantially simplify creating a list, but it greatly increases the versatility and flexibility in formatting an output, especially when coupled with List Handler's superb built-in routines for manipulating fields.

When you start the List Utility program and select the Create New List option from the main menu, the program displays the available control-character functions and prompts you for a selection. Available functions include Ctrl-I and Ctrl-D to insert and delete field names, Return to step through your list for editing, Ctrl-N to advance to the next video "page" once you've exceeded the screen limit of 10 fields per page, and Ctrl-X to clear the field name. The program provides no way to edit individual characters or words, but because most field names are short, this deficiency is not particularly bothersome.

More aggravating, at least until you get the hang of it, is List Handler's peculiar method for completing an entry. After you finish typing in a given field name, you use Ctrl-A to add this entry to your growing list and advance to the next field to be named. Out of habit we often found ourselves pressing Return instead of Ctrl-A. This miscue sends the cursor hopping back to the first field on the page and forces you to step down (pressing Return as necessary) to where you erred. Once you've finished defining the list format, you press

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Ctrl-W, and List Utility writes your list structure into a disk file.

Other options in the List Utility menu let you revise your list structure—even if the list already contains data. Again, you use control characters to add, delete, or change field names, and the program alters all records stored on disk to reflect your new design. List Handler expects each numbered field to be named, so if you forget to delete blank fields (especially at the end of your list), you're prompted to do so.

Entering Your Data

Once you've established a list design on disk, you can begin entering records by using the Add Records option from List Handler's primary menu. As before, the program displays applicable control characters; for the most part they are identical to those used earlier during list creation. However, Return has now reverted to its more conventional role of terminating entries, and Ctrl-A now adds a completed record entry to disk. If you mistakenly press Ctrl-A (as was required while naming fields), List Handler dumps an empty record to disk and then prompts you for another record to add. After making this mistake several times and then having to go back and delete each empty record, we finally became adjusted to the inconsistent use of Return and Ctrl-A. Still, standardizing the control characters would simplify the use of the program, and we hope the company considers this change in future versions.

During record entry, the program displays only five fields at any one time. Ctrl-N lets you flip the screen to the next page and continue entering the next batch of record information. At the last page of a record, pressing Ctrl-N returns you to the first page.

No Automatic Advance

List Handler does not automatically advance to a new page once you've filled a page, and this can cause problems. If you fill the five fields displayed and then neglect to press Ctrl-N, the cursor jumps to the first item on the same page and obliterates your prior entry if you carelessly resume typing. We found the simplest way of remembering to flip pages at the right time was to organize field names in logical groups of five (e.g., Address, City, State, Zip, Phone #), so that each new page requires different types of information.

List Handler provides no mechanism for rejecting incorrectly entered record information, so you must be sure to follow a uniform format for your entries. If partway through a record you discover you've missed an item and end up typing Durham in the State field, several Ctrl-Ns flip you back to the appropriate page, then Return

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drops you to the appropriate line. Your first keystroke wipes out the field as Ctrl-X does, so it's simple to backtrack and sequentially repair your errors.

Searching Through Your Data

Searches with List Handler are exceptionally fast and easy. When you select the Find Records option from the main menu, the screen prompts you for the type of search to be undertaken and displays the appropriate control characters. You use the left and right arrow keys to walk through the master field list to specify which fields you want to search, or you can search through all fields at once.

The program displays individually all records meeting your search criterion; the page containing the searched field appears first. Ctrl-N lets you flip to the next page in the same record, Ctrl-D deletes the record, and Return jumps to the next record that meets your search criterion. To change any field in the displayed record, press Ctrl-C; List Handler then provides a familiar list of applicable control characters. At this point you may well find yourself overwhelmed with too many control characters, but the program beeps the Apple's speaker if you inadvertently press an inactive character or one that's inappropriate to the task at hand. When you've completed your changes, press Ctrl-A to add the updated record to disk, Return to scan more records, or Ctrl-E to exit to the main menu and start a search with a different criterion.

Printing Features

List Handler provides versatile routines for printing form letters, labels, or impromptu lists. Choices are much more extensive than those available for doing searches and let you examine the contents of a specified field in any of eight different ways. Printout specifications (left, right, top, and bottom margins, lines per page, characters per line, and whether to stop between pages) are normally displayed with settings suitable for a form letter printed on standard 8½- by 11-inch paper. You can alter any or all of these specifications by using the program's standard editing technique: press Return to point to the incorrect parameter, then enter the new value.

An outstanding feature is List Handler's ability to compose printing formats directly on the screen just as they'll appear on paper. If you press Ctrl-F, the first field name from your master field list appears in the upper left-hand corner of the screen. You can then use the left and right arrow keys to walk through the field names as before. Pressing the space bar selects a field for printing; the cursor then leapfrogs this chosen field and prompts you for another. If you desire an additional field on the same line, simply press Ctrl-F and

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repeat the process. Pressing Return drops you to the next line, and Ctrl-X clears the entire line if necessary. You can add clarifying punctuation marks (or any text) between fields simply by typing the characters in before you press Ctrl-F and move to the next field. You can use this procedure to arrange any combination of fields from your master list.

Our Wish List

As with most applications software, List Handler is not without its limitations. Some improvements we'd like to see incorporated include:

- A method of searching more than one field at one time. It's particularly vexing that List Handler in its present form does not permit multiple-field searches. The program can search only for single fields (or for a single word wherever it may occur) in any one pass, which substantially reduces its ability to seek out specific record types. For example, you can't search for all records with a last name of Smith *and* a zip code of 10001. Working without this capability can be trying, especially if your list contains a large number of similar records. It would also be helpful to have a display indicating the number of records that fulfill a given search criterion.

- A way to automatically flag records that you've updated after initial entry. At present, you can define "Status as of:" as one of your field names and manually update this field as you change records. However, this procedure quickly grows tiresome if you have many modifications to make.

- A means to flag the record type so you can store mixed formats on the same disk. Most file managers share this deficiency, one that we expect might be difficult to correct. For example, as scientists, we would like to store and manage bibliographic information, but it's often published in quite disparate places: journals, books, chapters in multiauthored symposium volumes, government documents, and so on, each with differing but well-defined citation formats. None of the file managers we've investigated, List Handler included, can print out each record according to the format you establish by its output flag. Maybe a file manager with such a feature is too much to ask for, but we'd buy it in a minute if it were available.

Despite its limitations, List Handler is an exceptional program for all but the most demanding data-management applications. It guides you efficiently and forgives most of your mistakes. No other file manager we've used lets you change your data structure so conveniently, without requiring hours of frustration and tedium. □

At a Glance

Name: List Handler

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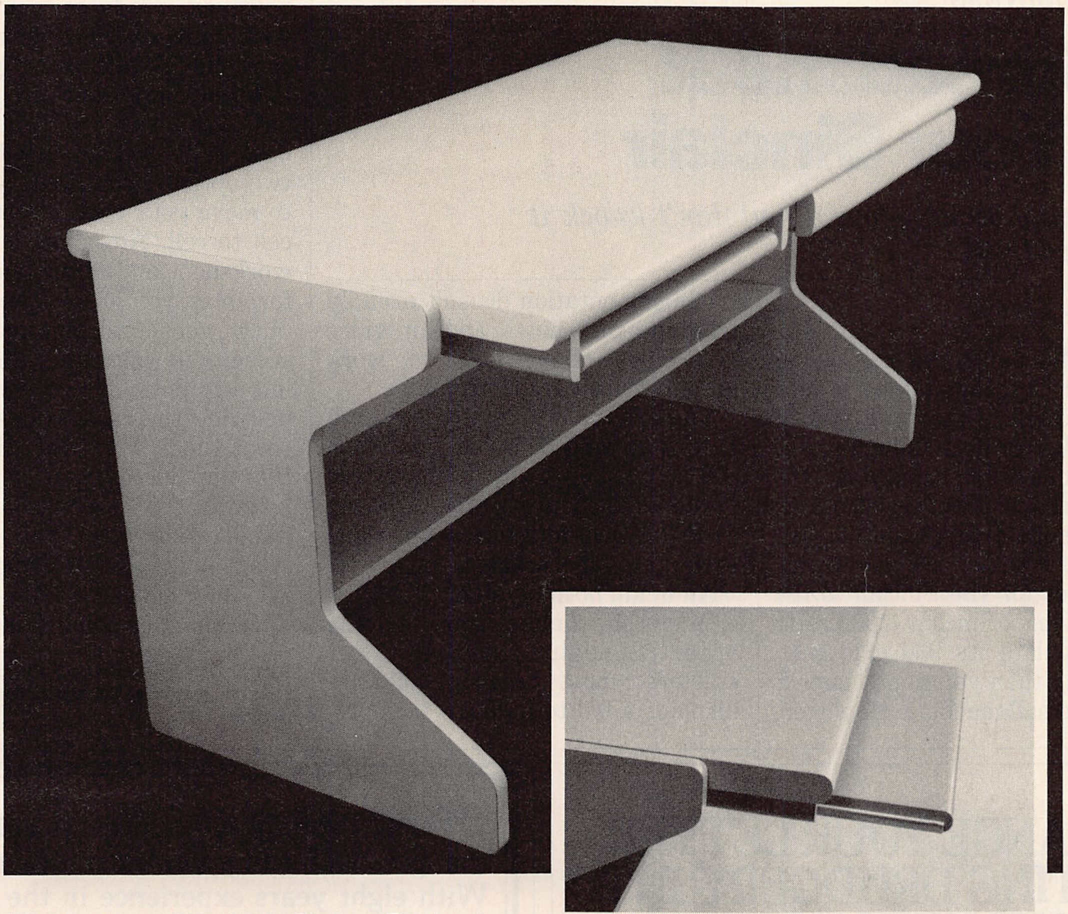

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HOME/BUSINESS

A Spreadsheet for Your Sinclair

Vucalc may be slow-footed, but don't knock it till you've tried it

by Ann L. Zevnik

Some of the companies marketing electronic spreadsheets would have you believe that the size of their display grid is all-important. But what really separates the superb packages from the also-rans is the ease of altering what's inside the grid. Vucalc, an electronic spreadsheet for the Sinclair ZX81 and the Timex/Sinclair 1000, lets you manipulate its 936 grid cells more easily than you might expect on such a small machine. However, the documentation doesn't proudly trumpet this news and provides few clues about how to work around Vucalc's shortcomings.

Vucalc's what-if comparisons are served up on a 36 by 26 grid. Each cell accepts up to eight characters or numerals. You can store as many as 40 different formulas at one time, each up to 32 characters long.

All in all, nothing about Vucalc is amateurish, unlike some of the other Sinclair packages. For starters, most Sinclair software displays a 0/0 to indicate that program loading is complete. Vucalc, however, produces a main menu with four choices: enter Vucalc, continue Vucalc using previously entered data, save program with data, and save program without data. When you work with the first two options, you press arrow keys to move your window rapidly from cell to cell. After you set up your worksheet and enter numbers and formulas, you press C and the computer goes into fast mode (blank screen) to calculate. This feature lets you enter information quickly, delaying the calculations until you want them. However, the calculation time increases with grid size—from a few seconds to several minutes—because the computer starts with cell A01 and goes to cell Z36 for each calculation.

Vucalc does some things as well

Ann L. Zevnik is editor of *Syntax* newsletter and *Syntax Quarterly* magazine, both for Timex/Sinclair users.

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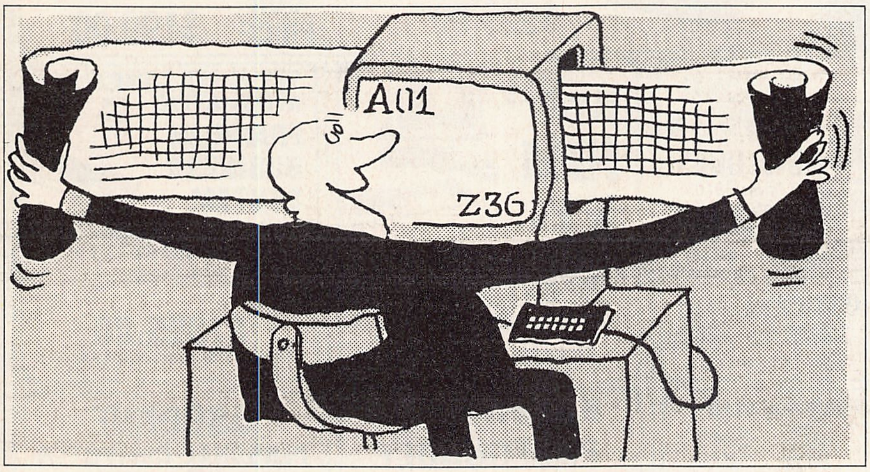

as—if not better than—the other spreadsheets. It gives you a nice big grid with row and column labels and an easily movable cursor. Holding down certain keys causes instructions to repeat. Vucalc allows lengthy formulas and can accept both alphanumeric and numeric input. As the program works on a cell, it displays any formula in that cell as well as the formula's value. If the program can't evaluate a cell while calculating, it displays an error message and tells you which cell caused the problem. And to minimize your chances for error, Vucalc is designed to disable many of the Timex/Sinclair keys that can cause invalid input.

So much for the good news. If you're familiar with other spreadsheets, you will find some features lacking here. First, Vucalc gives you no control over the display format. You cannot shorten the fractional computations to, say, two decimal places. Decimal points and digits do not line up in the columns. Only formulas can be copied from cell to cell. Worse still, the editing function is pretty crude: if you want to change an entry, you must retype the whole darn thing. And Vucalc offers no Go To command; except for cell A01, you must use the arrow keys to get wherever you're going. Lastly, as your grid gets larger, the time needed for calculations increases accordingly.

Despite these drawbacks, Vucalc is an impressive program for the Timex/Sinclair machines. The biggest headache is the documentation, which is neither thorough nor easy to read. The best way to learn how to use Vucalc is to spend time just pushing keys. You may discover with delight that your $79, "for learners only" computer is capable of doing real work for you. ☐

At a Glance

Name: Vucalc

Type
Electronic spreadsheet

Distributor
Sinclair Research Ltd.
3 Sinclair Plaza
Nashua, NH 03061
(603) 882-9534

Price
$14.95

Format
Cassette tape

Computer
Sinclair ZX81 or Timex/Sinclair 1000 with 16K-byte random-access memory

Documentation
7-page foldout from tape box

Audience
Home and small-business users

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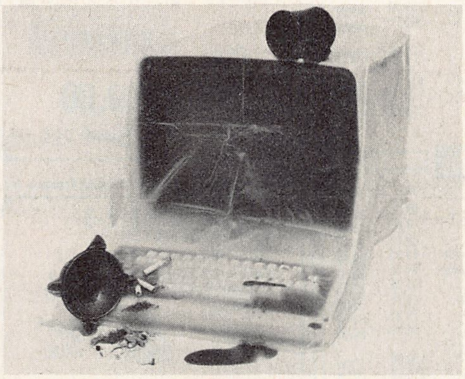

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GAMES

Maniac Mobile Mazogs

This may well be the breakthrough game for Timex/Sinclair computers

by Ann L. Zevnik

If you own a Sinclair ZX81 or Timex/Sinclair 1000, your choice of good games is limited by the machine's lack of color, sound, and adequate resolution. It's just not a game machine. As editor of a Sinclair users magazine, I've played many Sinclair games, and most of them do nothing to compensate for the machine's limitations. Mazogs, however, is a real standout.

Here's the scenario: you're somewhere in a maze, armed with nothing but your wits. You must find and escape with the glittering treasure—and your life. Along the way you can pick up swords to defend yourself from Mazogs, zealous guardians of the treasure. But you're not totally alone: past treasure seekers caught by Mazogs are bricked into the walls of the maze. These prisoners can point the way to the treasure and the exit. But remember—you can't carry the treasure and a sword at the same time.

Mazogs requires 16K bytes of random-access memory and, unlike most Sinclair software, is self-starting when loaded from tape. You choose among three levels of play: Try It Out, Face a Challenge, or Maniac Mobile Mazogs. The first level, primarily demonstrating the game, is relatively tame. Mazogs are stationary, and you must walk right into one before it fights. Level two adds moving Mazogs. In addition, the computer allots you a finite number of moves and keeps close track. Aimless wandering can prove just as fatal as a Mazog attack. When you progress to level three, Maniac Mobile Mazogs, you find just what the name implies—roving creatures who attack without provocation. Asking the friendly prisoners for directions kills them, thus careless questioners are left all alone with the blitzing 3Ms.

To start each game the computer generates the maze and checks the

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location of the treasure. If the puzzle is too easy, the computer redraws the maze or moves the treasure. At any time you can ask for an overview of the section you're in to see locations of swords, prisoners, and Mazogs or to find out how many moves you are from the treasure. The display fills the entire screen, and the maze extends far beyond the screen's borders. When you run through the maze, the display scrolls so your character always stays in the center of the screen. The animated graphics are quite good, particularly by present Timex/Sinclair standards. Holding down a key gives continuous, rapid motion (not a standard feature). And at game's end the computer displays the entire maze and the solution.

One serious drawback: to move through the maze, you press keys to indicate direction. You'll find this inconvenient, especially with Mazogs in hot pursuit. Mazogs (and other Timex/Sinclair games) cries out for a joystick for easier control.

The documentation walks you through all your choices in the order they occur. It also offers suggestions for conserving moves and outwitting Mazogs. However, the print is small and may cause some readers problems.

If you've found Sinclair games unchallenging, try Mazogs. You can lose fast, but you'll usually need 45 minutes to an hour to win. □

You'll meet up with failed treasure seekers bricked into the walls of the maze.

At a Glance

Name: Mazogs

Type
Entertainment

Distributor
Softsync Inc.
14 East 34th St.
New York, NY 10016
(212) 685-2080

Price
$19.95

Format
Cassette tape

Computer
Sinclair ZX81 or Timex/Sinclair 1000 with 16K-byte random-access memory

Documentation
4-page foldout from tape box

Audience
Game players who don't need the full-throttle excitement of arcade games

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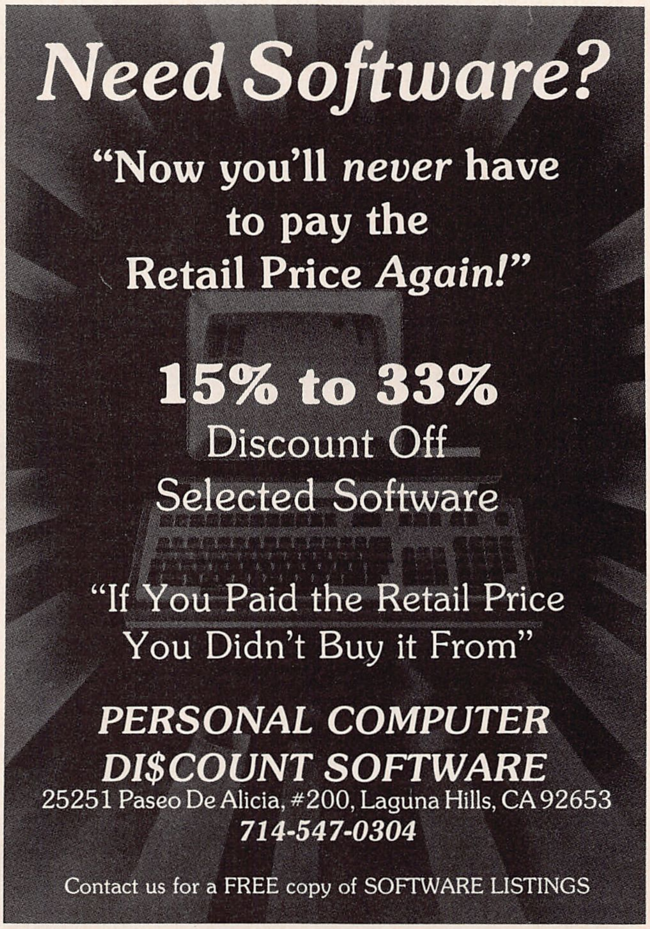

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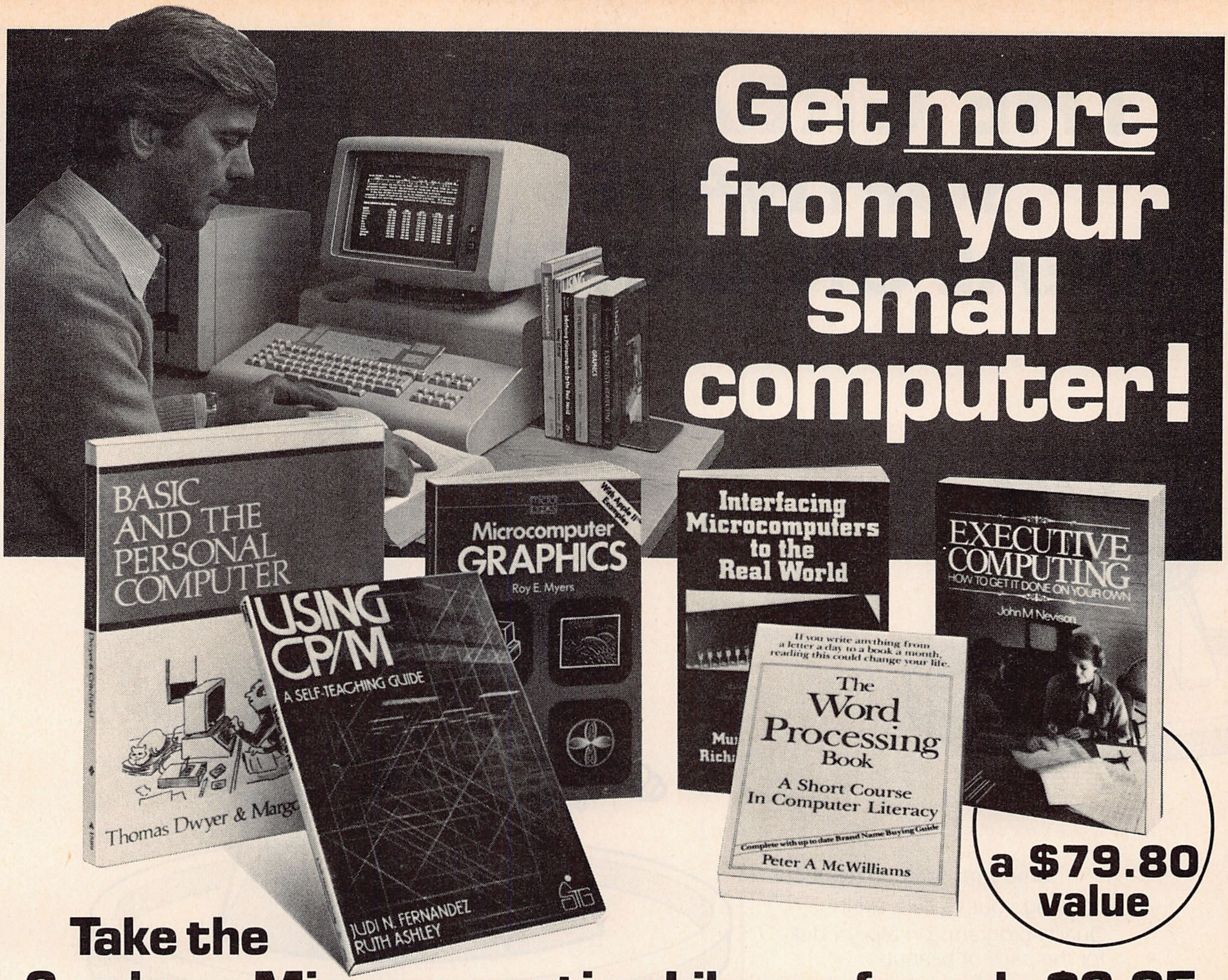
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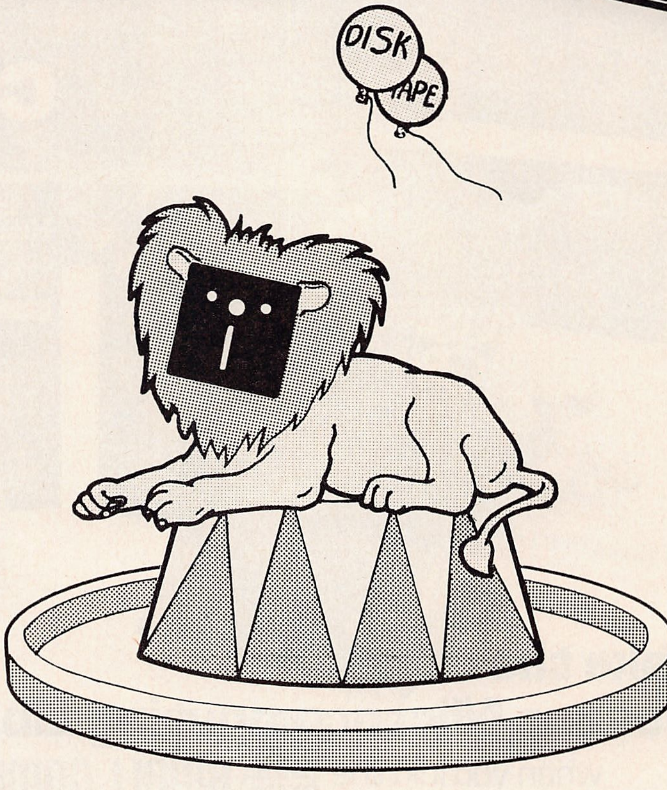

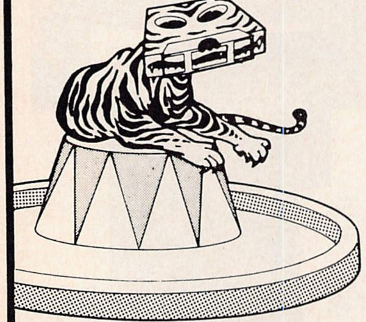

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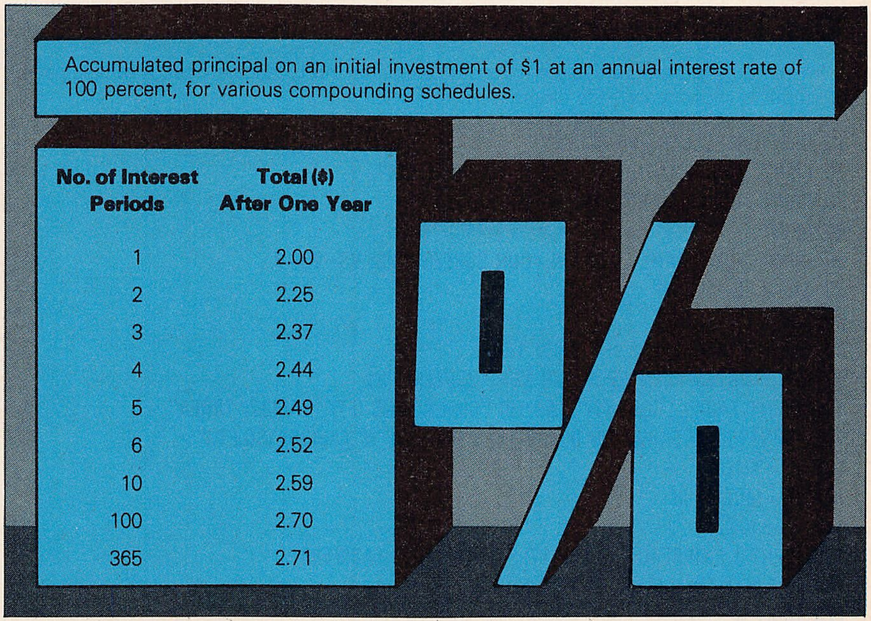
Much Ado About . . . Interest

Analyzing interest rates by computer can be fun and profitable

by Michael W. Ecker



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2	2.25
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4	2.44
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6	2.52
10	2.59
100	2.70
365	2.71

Since the recent liberalization of banking regulations, the subject of interest rates has generated a great deal of, well, interest. And rightfully so, because understanding this tricky subject can help you obtain the highest rate of return on your investment dollar.

This month, we'll suggest ways you might enlist your computer in the battle of the buck. Afterward, we'll take care of unfinished business from previous months.

On its new money-market savings account, Amalgamated Fat Cats Bank offers a 10.5 percent interest rate compounded semiannually. Just down the street, Community Free-Toaster Savings offers a 10.25 percent rate compounded daily (not to mention a free toaster when you open an account).

Obviously, Community's *nominal* interest rate is lower. But which bank offers a higher *effective* rate? In other words, which account actually earns more on a given initial investment over a year's time? The rate at which interest is compounded (calculated and added to the account) makes a great deal of difference in calculating the earnings. Banks and other savings institutions are required by law to quote the effective annual rate as well as the nominal rate, but consumers sometimes pay more attention to the nominal rate.

Other worthwhile questions come to mind. What nominal rate compounded daily gives an effective rate equivalent to that of a 10.5 percent nominal rate compounded semiannually? How long will it take to double an initial deposit held in such accounts? (Incidentally, the length of time it takes to double your money is independent of the amount of the initial investment. Fellow nonmillionaires, take heart!)

Before you rush off to this new challenge, let's review the basics of compound interest. To simplify our calculations, we'll look at an initial deposit of $1 in an account that pays a nominal interest rate of 100 percent annually under various compounding schemes (see the table above). For each compounding schedule, let's see how much money the account will hold after one year.

With only one interest period (annual compounding), the full 100 percent is to be paid at the end of a year, resulting in a total of $2. With two interest periods (semiannual compounding), you earn 50 percent after each six months. Those unfamiliar with compounding methods might think, "Well, 50 percent plus 50 percent equals 100 percent, so what's the difference?"

Contributing editor Michael W. Ecker is an assistant professor of mathematics at Pennsylvania State University (Worthington).

But the interest earned in the first six months ($.50) is added to the account, so that the next time interest is calculated, the principal is higher ($1.50), producing higher interest ($.75) and a higher net amount ($2.25).

Judging from the second column in the table, there appears to be a limit to how much you can gain by increasing the number of interest periods. What is that limit? Try to program your computer to produce an output like that in the table and perhaps to answer the question about the ultimate limit (interest compounded every second?). Next month I'll offer my solutions.

Thrifty Fence Builder Revisited

Last month's problem asked how to construct a rectangular fence. Grade A wood ($5 per foot) is to be used on the north and south sides, and grade B wood ($4 per foot) on the east and west. The challenge is to enclose the largest possible area while using $400 worth of fence material.

As with most of our projects, the solution to the problem has two parts: first, to write a BASIC program that finds the answer, and second, to explain any interesting patterns that show up.

Can you come up with a BASIC program to find the answer? One solution is shown at left, along with a sample page of output. Type in the program and run it. It's designed to work on any computer with a version of Microsoft BASIC. Here are a few comments on it.

Line 10 clears the screen. On some computers, another command (for example, HOME) does the same thing. Line 50 asks you to input the number of lines available on your screen. This value tells the program how many lines of information to show at once before it pauses. If you don't want the computer to pause at all, type in the number 403.

The variable M will be used to "remember" the largest area; this variable is updated each time the computer finds an area larger than its previous maximum. Variables SA and SB store the dimensions of the fence that produce the maximum area (see line 160).

Line 70 lets the cost of grade A material range from 1 to 399; the corresponding cost of grade B material ranges from 399 to 1. Lines 80 to 110 cause the program to pause before each new page of output and print a heading at the top of each page.

Lines 120 to 140 compute the lengths of the sides S1 (north and south) and S2 (east and west) and the total area A. Why is S1 calculated as K/10? If we spend K dollars on grade A wood, then K/2 of that amount goes for each of the two grade A sides. We know that the length of a side times the cost per foot equals the total cost of a side. Because grade A fencing costs $5 per foot, we have S1 × 5 = K/2. A little basic algebra turns this formula into the equation on line 120. Similar reasoning gives the formula for S2 in line 130.

You might want to vary the problem a bit to discern a pattern. For

The Thrifty Fence Builder

Type in this BASIC program to solve the problem of the thrifty fence builder. A sample page of output is shown below the program listing.

```
10 CLS: REM—CLEAR THE SCREEN
20 PRINT "ONE SOLUTION TO THE FENCE PROBLEM"
30 PRINT "USING A TRIAL-AND-ERROR METHOD"
40 PRINT
50 INPUT "HOW MANY LINES ON YOUR SCREEN"; VS: VS=VS-3
60 SA=0:SB=0:M=0
70 FOR K=1 TO 399
80 IF K-INT(K/VS)*VS<>1 THEN 120
90 INPUT"PRESS <ENTER> FOR NEXT SCREEN"; X$
100 PRINT TAB(2) "COST ($)" TAB(18) "DIMENSIONS (FT)" TAB(37) "AREA"
110 PRINT"GD A"TAB(8)"GD B"TAB(18)"L"TAB(25)"W"TAB(35)"(SQ.FT.)"
120 S1=K/10
130 S2=(400-K)/8
140 A=S1*S2
150 PRINT K;TAB(8);400-K;TAB(17);S1;TAB(24);S2;TAB(35);A
160 IF A>M THEN M=A: SA=S1: SB=S2
170 NEXT K
180 INPUT "PRESS <ENTER> FOR FINAL RESULTS";X$
190 PRINT "THE MAXIMUM AREA EQUALS" M "SQ.FT. USING"
200 PRINT SA "FT. OF GRADE A AND" SB "FT. OF GRADE B"
210 END
```

```
    COST ($)                DIMENSIONS (FT)           AREA
GD A       GD B          L            W              (SQ.FT)
 29        371          2.9          46.375          134.488
 30        370          3            46.25           138.75
 31        369          3.1          46.125          142.988
 32        368          3.2          46              147.2
 33        367          3.3          45.875          151.388
 34        366          3.4          45.75           155.55
 35        365          3.5          45.625          159.688
 36        364          3.6          45.5            163.8
 37        363          3.7          45.375          167.888
 38        362          3.8          45.25           171.95
 39        361          3.9          45.125          175.988
```

instance, suppose the north side of the area has a natural boundary, making it unnecessary to build a wall there. How then should you allocate the $400 between grade A wood (southern wall) and grade B wood (east and west walls) to produce the maximum area? Experiment, either on paper or using your computer. Next month I'll reveal a delightful pattern that provides a general answer to all such questions in one fell swoop.

Eccentric Jailer Explained

Did you run the jailer program from last month? If you did, then you should have found a striking result, namely, that the only cells open after 100 seconds are those whose number is a perfect square. (Perfect squares are numbers p such that $p = n \times n$ for some whole number n.)

In particular, the open cells are numbered 1, 4, 9, 16, 25, 36, 49, 64, 81, and 100—the squares of the numbers 1 through 10 respectively. Surely such an answer cannot be a complete accident, can it?

A little number theory comes to the rescue here. It tells us that only perfect squares have an odd number of divisors. Recall that a cell becomes open if and only if its number has an odd number of divisors. Our jailer program identified cell numbers with an odd number of divisors; our newly acquired number theory explains why these also happened to be perfect squares.

Here's an intuitive explanation of the theory. Take the perfect square 36 and list its divisors: 1, 2, 3, 4, 6, 9, 12, 18, 36. Now note that we can pair these divisors so that each pair when multiplied produces the number 36: 1×36, 2×18, 3×12, 4×9. The number 6 is the odd man out—we have nothing to pair it with because $6 \times 6 = 36$ and we can't count 6 twice in our list.

The same situation holds true for any perfect square. When you pair up the divisors of a perfect square, you're left with one number that is its own match, namely, the square root of the original number. This gives k pairs + 1, or a total of $2 \times k + 1$, which is always an odd number. In summary, every perfect square has an odd number of divisors. Conversely, if a number is not a perfect square, then it must have an even number of divisors.

Illustration by Wilbur Bullock

Perhaps you can come up with improvements or interesting variations on the programs presented in this department. Or maybe you'd like me to discuss a favorite puzzle of yours. If so, write directly to me (enclose a stamped, self-addressed envelope if you want a reply):

Michael W. Ecker
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Popular Computing
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□

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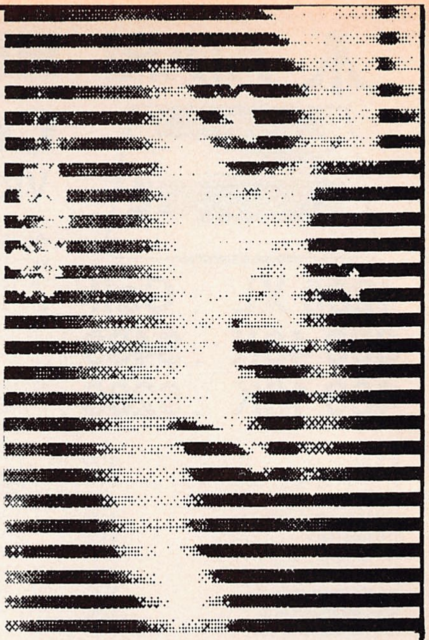

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After reading this issue of *Popular Computing*, you are now fully aware of the many outstanding printers on the market today. But what you might not be aware of is that the printer you like best, might not be compatible with your computer and software. (The picture above is a good example of printer incompatibility.) At the **Printer Store** we specialize in printers, so our experienced professional staff can help you choose the right printer for your personal and business needs. If you want the **Best Value, Low Price, Product Availability,** and **Support,** call The Printer Store today and ask us about:

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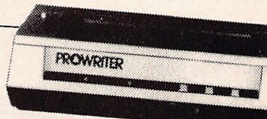

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THE **Printer** STORE — 2357 Westwood Blvd., West Los Angeles, CA 90064

Circle 112 on inquiry card.

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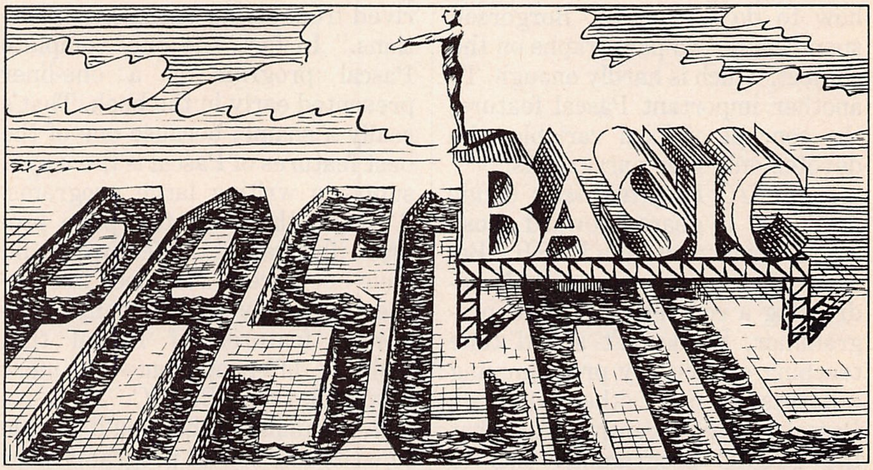
Shifting from BASIC to Pascal

BASIC programmers who take the Pascal plunge may need a lot of help

A BASIC Programmer's Guide to Pascal

Mark J. Borgerson
John Wiley & Sons Inc.
New York, 1982
116 pages, softcover, $9.95
Reviewed by Jonathan Amsterdam



Most BASIC programmers probably don't realize they're using a language that was obsolete a decade ago. In fact, most would bridle at the very suggestion. After all, every microcomputer on the market uses BASIC. More software for microcomputers has been written in BASIC than in any other language. BASIC is the de facto standard language for the entire industry, right? Obsolete? Nonsense!

Well, think again. And if you don't believe me, just ask the computer science professors at any college or university. They'll tell you what Edsger W. Dijkstra, one of the world's leading computer scientists, told them 10 years ago: languages like BASIC and FORTRAN, which don't support the structured style of programming, are bad news.

Structured programming is a discipline that demands that programs be written in relatively small, independent pieces. It's easier to write very complex programs when you break them down into manageable chunks. BASIC doesn't support this style of programming, but—in case you haven't guessed by now—Pascal is well suited to it. Pascal is the second most popular microcomputer programming language, and it is rapidly gaining on Number One. Pretty soon, a lot of BASIC programmers out there will have to learn it.

According to Dijkstra, learning Pascal won't be easy for those who were brought up on BASIC. He recently said, "It is practically impossible to teach good programming to students who have had prior exposure to BASIC. As potential programmers they are mentally mutilated beyond hope of regeneration." But don't worry; I was a BASIC programmer myself once, and my brain is still in one piece. So if you're tired of BASIC and think you're ready to take the Pascal plunge, all you need is the right teacher.

Enter Mark Borgerson and his book, *A BASIC Programmer's Guide to Pascal*. Borgerson explains Pascal by comparing its features to similar features in BASIC. This approach is possible because all computer languages have the same set of basic operations; the differences are mostly syntactic. For example, the BASIC statement "LET X = 5" is expressed as "X:=5" in Pascal. Both statements mean the same thing, as any BASIC programmer reading a textbook on Pascal would immediately notice. The interesting thing about Borgerson's book is that he explicitly points out this correspondence as well as the many others that exist. In fact, the best part of the book is its brief glossary, which lists BASIC state-

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Jonathan Amsterdam works in the Artificial Intelligence Lab at MIT.

Illustration by Gil Eisner

ments and their Pascal equivalents. It's a great way to learn a new language—just translate it, word by word, into one you already know.

Unfortunately, that approach doesn't always work because certain features of Pascal have no BASIC counterpart. For example, the GOTO statement, a BASIC staple, is unnecessary in Pascal. For many BASIC programmers, writing programs without GOTO is difficult and takes some practice. Any book that purports to teach Pascal to BASIC programmers should spend some time showing how to do without it. Borgerson spends only two paragraphs on the subject, which is hardly enough. To another important Pascal feature, the concept of local variables, he devotes only four paragraphs.

A BASIC Programmer's Guide to Pascal is geared toward those who are well versed in BASIC. Because the author assumes he's addressing a competent BASIC programmer, he doesn't spend time teaching elementary programming concepts, as most other books on Pascal do. He concentrates on what the BASIC programmer has to learn. The book begins with an overall look at a Pascal program and then goes on to examine the many different ways of structuring data in that language. The four chapters on data structures are the best in the book. Borgerson takes up each data structure in turn, from the simple to the complex, compares it with its BASIC counterpart, and discusses its possible uses. After that, Borgerson devotes separate chapters to input/output, control structures, and overall program design.

Although the book has its good points, it also has its share of flaws. To begin with, Borgerson's book is introductory; it won't tell you everything about Pascal. After reading it, you'll want to get a more comprehensive book or manual. In addition, the book is poorly organized. A typical case in point: material is often presented before it is explained. For instance, the first few examples in the book include the "writeln" statement. It stands for "write line," and it's exactly the same as the BASIC PRINT statement. But instead of explaining that when it is first mentioned, Borgerson waits a few pages.

Another serious problem is a lack of examples. Borgerson illustrates his points with many short program fragments, but we never see a full-fledged Pascal program that does something interesting, even though in the preface Borgerson promises "program examples derived from actual business applications." In fact, the only complete Pascal program is a one-liner presented early in the book. That's really a shame, because one of the best features of Pascal is the way it supports writing large programs. A single three- or four-page program illustrating the feature would have been great. Nor does Borgerson adequately explain many of the special features of Pascal that make it different from—and more powerful than—BASIC. As a result, it's unlikely that you'll be able to write any Pascal programs after reading this book. At best, you'll have a fair reading knowledge of the language.

Another shortcoming really gets my goat. Borgerson owns an Apple computer, and he lets you know it. You'd think 116 pages would provide just enough space to cover the major features of Pascal in detail. Instead, Borgerson leaves out some important features and talks about certain features peculiar to Apple's brand of Pascal, UCSD Pascal. He spends a full chapter and part of a second on some nonstandard file types and operations of Pascal. He even devotes a chapter to the UCSD Pascal Operating System, whose only connection to the Pascal language is that it has the word "Pascal" in it. He also provides some routines that are specifically for the Apple II computer. That's nice for Apple owners, but not for anyone else. None of this would be so bad if we had been told about it. If a book is a guide to UCSD Pascal for the Apple computer, its title should reflect that.

It's really too bad that this book isn't a winner. The idea of teaching Pascal by comparing it with BASIC is a pretty good one. But *A BASIC Programmer's Guide to Pascal* just doesn't follow through. If you're a BASIC programmer who wants a quick introduction to Pascal, you might want to glance at it. But you'll have to look elsewhere if you want to completely undo the "mentally mutilating" effects of BASIC.

Logo for the Apple II

Harold Abelson
BYTE/McGraw-Hill
Peterborough, NH, 1982
228 pages, softcover, $14.95
Reviewed by Tom McMillan

Logo is a computer programming language that was originally developed for educational purposes. Designed to be easy for children to use to create their own programs, it also incorporates advanced programming techniques that have evolved from a branch of computer science called artificial intelligence. Programming in Logo consists of creating new commands, called *procedures*, from commands that are already understood by the computer. In this way, each new procedure can be used to construct the next, and a complex program can be built up, piece by piece.

Three hypotheses support this approach. First, the exploration, planning, and problem solving involved in creating a workable program are themselves educational experiences. Second, successful Logo programs embody valid models for describing challenging problems in many fields. Finally, seeing their Logo programs under development enables beginners to trace and review their thought processes.

This intriguing philosophy of education is not Harold Abelson's primary concern. Instead, *Logo for the Apple II* is a thoughtful and straightforward tutorial guide to the Logo language itself, and it is definitely geared toward adults. Abelson begins with a self-contained course in turtle graphics and follows that with a brief detour into "housekeeping" functions such as saving and retrieving files. Then he plunges into more advanced features of Logo, such as recursive programming and list processing. The book ends with some rather complex examples: a program that simulates a "natural" conversation between the computer and a user and one in which the computer imitates the process of learning.

The first few chapters, which deal with turtle graphics, are simple enough for readers who have never touched a computer before. The Logo turtle, a computer-controlled robot that moves around and draws lines on a graphics screen, serves to introduce the basics of defining and editing Logo procedures. Abelson's clear presentation of these fundamentals, along with a rich collection of sample drawings made by the turtle, gives a Logo learner the knowledge and confidence to begin creating original procedures and geometric designs. (Readers with an interest in the intricate and elegant mathematics involved in turtle graphics are invited to explore another Abelson book, *Turtle Geometry,* co-authored with Andrea diSessa and published by MIT Press in 1981.)

The reader in search of more sophisticated applications will not have long to wait. Chapters 5 and 6 of *Logo for the Apple II* present the basic Logo syntax for dealing with numbers, *words* (strings) and *lists* (collections of strings), and examples of procedures that use these techniques for simple data processing. Chapter 7 deals with interactive programs, including an animation program in which you control a constantly moving turtle by pressing keys on the keyboard. Many of the procedures described in these chapters generate *outputs*; that is, messages passed from one procedure to another.

In Chapters 8 and 9 Abelson describes the use of *recursion* in procedures that manipulate lists. The key to the use of Logo as an advanced programming language, recursion is a technique that enables a programmer to reduce certain difficult problems "to simpler problems of the same sort." Although the concept was introduced as early as chapter 2, it does not receive full treatment until this point. Rather than give us a specific path to follow through these chapters, the author presents examples that demonstate the use of recursive programming techniques. Several extremely useful charts have been included to help explain the workings of such procedures visually, which strongly reinforces the explanations given in the text.

While Logo was intended to be an introductory language, it is far from simplistic. In fact, what starts out seeming simple or even trivial at first can with a small shift of emphasis or a slight increase in complexity become quite difficult to follow. And while Abelson should be commended for including so many aspects of Logo in this book, a warning to the reader is in order: the water deepens rapidly through the middle of the book, and taking steps that are too big can put you over your head rather suddenly.

The author has given careful thought to the order in which he presents new concepts, and the tutorial is most effective if you follow along accordingly. On the other hand, you won't be taking full advantage of the book unless you stop to explore the examples and suggestions presented along the way. And in a sense, the book never really ends because you can

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continue to explore the use of Logo long after completing the book. You'll also want to reread sections that may have been difficult to understand the first time around.

The book is designed to be used alongside the computer. Its clean, readable design and spiral binding make it easy to use while you're sitting at the keyboard. It also includes a comprehensive glossary of Logo commands—a handy reference. In keeping with the book's use as a hands-on guide to the language, the author has adapted it for different versions of Logo. *Logo for the Apple II* is intended for use with the version of Logo developed at Massachusetts Institute of Technology and distributed by Terrapin Inc. and Krell Software Inc. (The book is available in two other versions, under the titles *Apple Logo* and *TI Logo*, which custom-tailor the tutorial to those forms of the language. Appendixes in *Logo for the Apple II* offer guidance for users of Apple Logo and TI Logo, but ideally you should obtain the volume that matches the version of Logo you plan to use.)

In the introduction to *Logo for the Apple II*, Harold Abelson speaks as one of Logo's developers when he expresses the hope that "the widespread availability of a simple, yet powerful, programming language will help to place the power to understand and control computers within the reach of everyone." Becoming familiar with Logo has given me a sense of that power, and the excellent introduction I received from Abelson's book made that possible.

RUN: Computer Education

Edited by Dennis O. Harper
and James H. Stewart
Brooks/Cole Publishing Company
Belmont, CA, 1983
245 pages, softcover, $15.95
Reviewed by Susie Hochenberg

There's a well-known saying that the whole is not necessarily the sum of its parts. That's especially true if the whole is a book of ar-

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ticles excerpted from many different sources. But *RUN: Computer Education*, a large-format paperback edited by Dennis O. Harper and James H. Stewart, is an exception. This book should be required reading for anyone involved in making decisions about the use of computers in the classroom. Even if you have no immediate plans to step inside a classroom, I'd recommend sampling these articles.

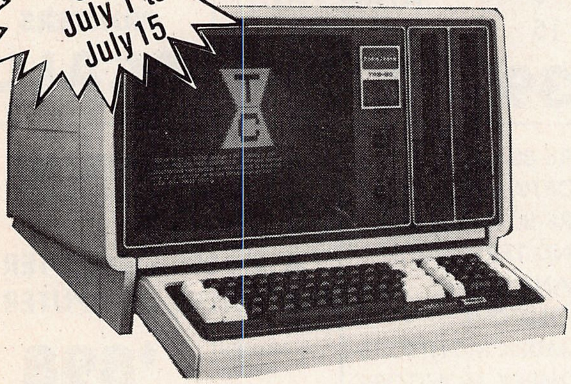
The editors have assembled an excellent collection of articles that focus on the human side of computers in a changing world. Selected from magazines such as *The Computing Teacher*, *Educational Technology*, and *Creative Computing* as well as from papers delivered at several national conferences on educational computing, the articles will whet your appetite on a wide range of topics, and ample bibliographies will direct you to further information.

Among the book's contributors are respected authorities such as Seymour Papert and Karen Billings, whose names will be familiar to readers of *Popular Computing*. Many interesting contributions also come from writers who are less well known. Soviet scientist A. P. Ershow, for example, is represented by an article on "Programming, the Second Literacy."

RUN: Computer Education provides an eye-opening view of how educators are thinking about and using the microcomputer in the classroom. If you have a practical bent, you may want to skim such topics as "Thinking and Learning Theory," "Computer Literacy," "Teacher Education," and "Computer-Assisted Instruction" in the first half of the book and concentrate on the more concrete second half. But if you haven't already read Seymour Papert's best-seller *Mindstorms*, on the origins of Logo, slow down and enjoy his brilliant assessment of the computer as a learning tool. He points out that the computer "is not a culture unto itself, but it can advance very different cultural and philosophical outlooks." Papert's point is borne out by the variety of perspectives represented in the book.

One short essay, "Computerphobia: What to Do about It," by Timothy B. Jay, addresses future prospects for people who grew up in the precomputer world. The chapter on computer-assisted instruction (CAI) shows that drill and practice, once considered a stepchild of the computer age, is coming back in vogue in a new, innovative form. No longer merely an electronic extension of the student's workbook, CAI may take on a new worldwide importance.

If you are already a believer in the significance of educational com-



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puting, the best part of the book may be the follow-up questions and activities at the end of each chapter. I particularly enjoyed the way that the editors play devil's advocate in presenting controversial issues and then let the reader be the judge. For example, they throw these points of view open to debate:

- Americans should expand the Bill of Rights to include freedom of computation, empowering the government to legislate computer availability for everyone.
- We simply cannot expect 25,000 to 50,000 schoolteachers to invent curricula and prepare materials for students to use. Therefore, software should be accessible from a national database, with each customer paying for this access.
- Women will have fewer opportunities for jobs in the future if they do not become computer literate.
- Schools cannot afford to produce software relevant to minority populations.

The articles, questions, and exercises will help you to formulate your own questions and decide the answers for yourself—or make you aware that there may not be any easy answers to such questions.

Chapters entitled "Software and Hardware Selection," "Computers in the Arts and Humanities," "Ethical and Social Issues," and "Exceptional Students" increase our sense of what is possible and practical in computer education. Computer games are fun, but incorporating learning games into the classroom may mean a reordering of priorities. Several authors point out that the computer can be a tool to help someone learn how to learn and that a good parent or teacher will carefully adapt the learning experience to the individual child. Michael Potts ("Smart Programs, Dumb Programs") describes in some detail how adventure games and simulations such as Tai-pan and Hammurabi can turn a young person's interest in games into a decision-making learning experience based on socioeconomic variables.

I'd like to suggest two small improvements for future editions of *RUN: Computer Education*. First, I'd add some illustrations and photographs because visual aspects of computer education are so important. Second, I'd add sample programs or lists of available software to demonstrate the ideas in each chapter. But these are minor objections. Overall, editors Harper and Stewart deserve our thanks for assembling such a valuable and thoughtful series of articles. If you enjoy reading short excerpts that represent a range of styles and viewpoints, this book is for you.

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END
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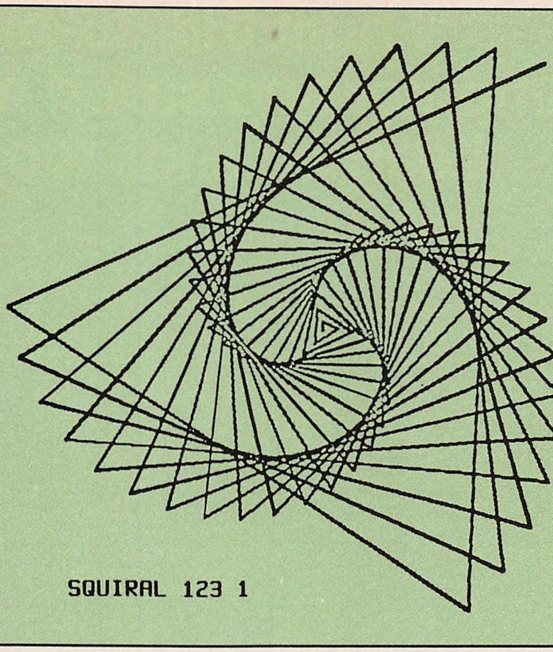

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The Timex Personal Computer Made Simple

Joe Campbell, Jonathan D. Siminoff, and Jean Yates
Signet/New American Library
New York, 1982
149 pages, softcover, $3.50

Byteing Deeper into Your Timex/Sinclair 1000

Mark Harrison
John Wiley and Sons Inc.
New York, 1982
160 pages, softcover, $12.95
Reviewed by Robert D. Swearengin

Once you get acquainted with it, the Timex/Sinclair 1000 is a friendly little machine that has considerable capabilities for its size and price. But if you're a beginner and you rely on the accompanying instruction manual, the friendship may be somewhat strained. Although it's both handy and well written, the manual presupposes a level of understanding that most novices may not have. That is, alas, the problem with many computer guides.

As a two-time loser in college algebra with no computer experience, I had no trouble adding 2 and 2 in the second chapter. But as the instruction manual says, "You do not need to buy a computer to work that out." About halfway through the manual, though, I was adrift in a sea of strings, logarithms, and prime numbers. Unfortunately, I couldn't take out my frustration on the machine; the T/S 1000 will not respond to four-letter words—unless, of course, they're programmed in BASIC.

Then I found *The Timex Personal Computer Made Simple*. I skimmed the first chapters, directions for unpacking the T/S 1000 and its components. "As you've probably guessed," the book says, "the computer is the object with the keyboard printed on top."

"At last," I thought. "Someone has finally written a computer book for me."

Made Simple is not a book for hackers. Instead, it is a primer, written in plain, simple English. "The only thing you won't find in this guide is jargon," the back cover states. That statement may be a bit ambitious, but what the book does contain is understandable and easy to read.

For example, one of the troubleshooting hints in Chapter 1 is that you try another TV if the computer doesn't work: "If you have one, a good-quality, small, black-and-white portable is best." Oversimplified? Probably not, for the typical new owner of the T/S 1000. My computer absolutely refused to be tuned to either of my color sets. I suppressed my tantrum and tried my black-and-white portable, and it worked perfectly. Such simple tips help the newcomer persevere in the complex and often frustrating world of computers.

The book also introduces strings, variables, and commands. Printing a screen full of "Hellos" at start-up makes the T/S 1000 seem more friendly and leads on to REM statements, computer priorities, and the CLEAR, NEW, RUN, LOAD, and CLS commands.

One chapter is devoted to a simple seven-line program for playing dice, and the authors explain what each line actually does. It's a good introduction to if...then statements and how to generate a given number of random integers. "Wow," I told my wife. "I finally understand LET A=A−1 in line 100." She wasn't particularly impressed, but it was a real breakthrough for me. For the very first time, I had actually analyzed a simple program, line by line.

A subsequent chapter uses string variables to expand the program and make actual dice—instead of numbers only—appear on the screen. It's a good exercise in creating a program and then improving it.

The space devoted to programming tips is probably the most important section in the book if you're truly interested in conversing with the T/S 1000. It's full of nitty-gritty information on FAST and SLOW modes, PRINT, TAB, SCROLL, PLOT, UNPLOT, FOR/NEXT loops, VAL, CODE, and CHR$. I only wish the authors had expanded this chapter.

Another good chapter explains how to save programs on tape, and separate chapters offer game, educational, home, and business programs—about 30 in all. Most will run on the 1K-byte Sinclair ZX81, a fact the authors neglect to point out. A couple of the longer ones, however, will not. I was happily programming away on Space Blaster when the ZX81 memory filled up at line 370.

Appendixes include guides to computer accessories, publications, suppliers, users groups, and report codes.

Compared to *Made Simple, Byteing Deeper into Your Timex/Sinclair 1000* does pretty much what its title implies. Written for owners with "no previous computer experience and others who are not new to computing but require more assistance," this book goes into greater detail and is somewhat more complex. At the same time, it's quite readable. One of its nice features is that entries are illustrated with drawings of the appropriate cursor and the key to be pressed. I finished the book in one sitting before I decided to play with some of the 37 programs it offers.

The book states at the outset that its programs will run on both the T/S 1000 and the ZX81. And it includes program changes for the older ZX80 with 8K-byte ROM (read-only memory).

Byteing Deeper was written to accompany the British version of the computer, but that presents only minor problems. First, you have to substitute DELETE for RUBOUT and ENTER for NEW LINE on the keyboard. Second,

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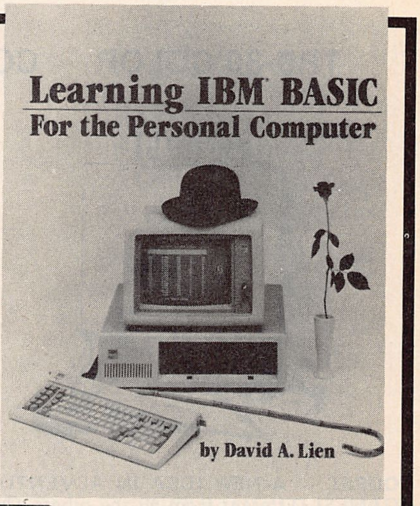

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the diagram shows the computer hooked to a UHF set. UHF won't work on the American version without a circuit-board wiring change.

While some sections of the book are extremely simple, others are fairly complex. Chapter 1 ranges from an easy-to-understand flowchart of principal computer components to a comparison of decimal, binary, and hexadecimal numbers that may confuse anyone who's not a mathematician. Chapter 2, on algorithms, offers a beautifully simple flowchart on how computer programs work but never really defines an algorithm. The introduction to the computer, on the other hand, is excellent, and the chapter on ZX81 BASIC does a good job of explaining variables and how the computer handles numbers.

Separate chapters on statements, functions, the character set, loading and saving, and crashing are straightforward and fairly easy to understand. One chapter includes a helpful breakdown of "what goes where" in the computer memory and supplements the discussion with diagrams. Chapters on speaking logically, using INKEY$, and PEEKING and POKING will probably require some additional thought and study if you're a beginner.

A section on programming offers nifty tips for saving memory and translating other dialects of BASIC as well as several good game programs. The author's line-by-line explanations of how each program works are excellent. Once you understand the program, you can add your own frills. As a slot-machine freak, I especially enjoyed tinkering with a program called One-Armed Bandit. Immersed in play, I learned more and more about programming.

The book concludes with suggested projects for readers. This section is a good introduction if you're interested in designing simple game programs.

Byteing Deeper is a worthwhile book. One typographical problem, however, is guaranteed to frustrate the fledgling programmer: the zeros in the program listings have no slash marks. Fortunately, the trusty T/S 1000 returns an error code and line number for improper entries. When that happens, it's probably because you incorrectly typed the letter "O" when it should have been a zero.

Both books are geared to the beginner, but there is surprisingly little duplication between the two. After reading them, I now find myself referring to the original computer manual with much greater understanding. If you don't know a bit from a byte, these may be just the books you need. □

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The Matchstick Game

Watch your computer learn from its mistakes until it plays perfectly

by Rosemarie and Peter Gabriele

The Matchstick Game is played with 21 matchsticks on a table (other variations involve stones, coins, or toothpicks). Two players take turns removing sticks from the pile in groups of one, two, or three. The object is to leave your opponent with the last stick.

It's an amusing pastime, until you discover that whoever plays second always wins—if that player follows a very simple strategy. The figure on the next page shows a typical game. Try a few rounds with a friend. Can you guess the winning strategy?

This month we'll program the computer to play the Matchstick Game. That's nothing new in itself, but unlike the typical programs that give the computer a winning strategy from the start, our program lets the computer learn from its mistakes until it *discovers* the winning strategy.

How It Works

While you may discover the winning strategy in a flash of insight, the computer follows a plodding, trial-and-error method to solve the puzzle. The computer maintains a table showing the win/lose rating of every possible move. Because the game can have 21 possible pile sizes and 3 possible moves for each pile size, the table must contain 63 individual ratings. A rating of 0 indicates that a move has not resulted in a loss. A rating of 1 marks a move as a loser.

When you first run the program, every move is rated 0 (okay). Whenever the computer loses a game, it goes back to its latest decision and marks that decision with a 1, indicating a bad move.

One result of using this approach is that the computer learns only when it loses—winning a game has no effect on its internal strategy table. It takes quite a few losses before the computer has marked every possible bad move. In fact, the computer has to make every possible bad move before its table is correct. After that, the computer will win every time you make the first move. It will win when it plays first as well, if you make a single mistake.

The Program

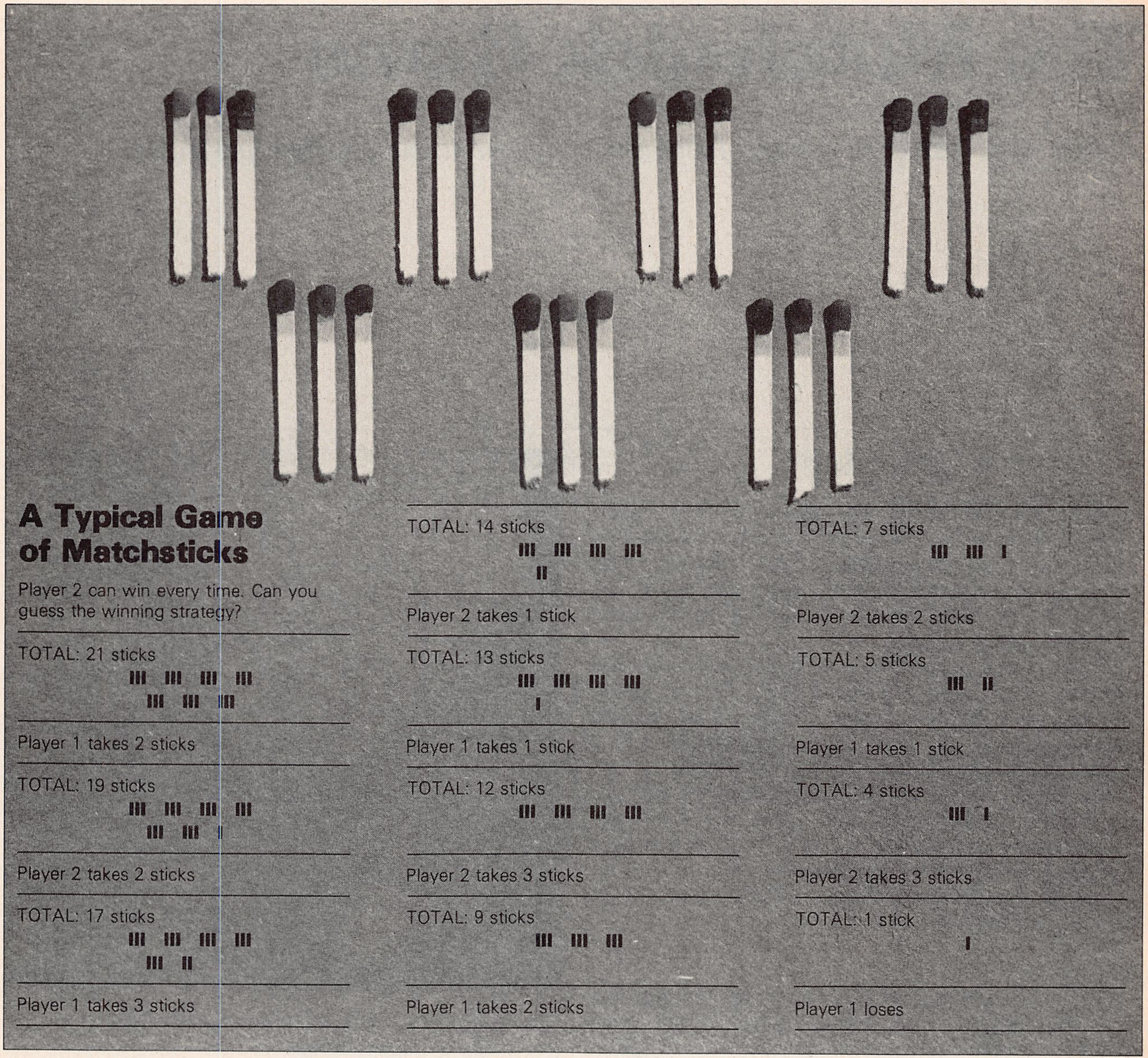
Our program is written in Microsoft BASIC. It should run on just about any computer equipped with BASIC, with a few possible modifications we'll mention as we go along.

Start by typing in these lines:

```
10 DIM GS%(21,3),PL$(2)
20 VS%-20
30 PL$(1)-"COMPUTER ": PL$(2)-"PLAYER "
40 FOR I-1 TO 21
50 FOR J-1 TO 3
```

Rosemarie and Peter Gabriele are freelance writers and computer training consultants in Stamford, Connecticut. Their most recent book is *Game Techniques in Applesoft BASIC* (Devin-Adair Publishers, 143 Sound Beach Ave., Old Greenwich, CT 06870; 1983).

Photographs by Ed Crabtree



A Typical Game of Matchsticks

Player 2 can win every time. Can you guess the winning strategy?

TOTAL: 21 sticks
III III III III
III III III

Player 1 takes 2 sticks

TOTAL: 19 sticks
III III III III
III III I

Player 2 takes 2 sticks

TOTAL: 17 sticks
III III III III
III II

Player 1 takes 3 sticks

TOTAL: 14 sticks
III III III III
II

Player 2 takes 1 stick

TOTAL: 13 sticks
III III III III
I

Player 1 takes 1 stick

TOTAL: 12 sticks
III III III III

Player 2 takes 3 sticks

TOTAL: 9 sticks
III III III

Player 1 takes 2 sticks

TOTAL: 7 sticks
III III I

Player 2 takes 2 sticks

TOTAL: 5 sticks
III II

Player 1 takes 1 stick

TOTAL: 4 sticks
III I

Player 2 takes 3 sticks

TOTAL: 1 stick
I

Player 1 loses

```
 60 GS%(I,J)=0
 70 NEXT J,I
 80 SZ%=21
 90 SW%=RND(2)
100 DS%=0
110 PL%=SZ%
120 WT%=100:GOSUB 580
```

Line 10 creates two arrays. GS%(,) is the game strategy table, in which the first subscript refers to the pile size, and the second subscript, to the move. For example, the array element GS%(5,1) contains the rating for the move "5 pieces left, take 1 stick." PL$( ) contains the names of the two participants; PL$(1) is the computer, and PL$(2) is the opposing player.

By the way, throughout the program the $ indicates a string variable and the % indicates an integer variable. If your computer uses some other means of differentiating between these two kinds of variables, you'll need to change all variable names accordingly.

Line 20 tells the program how many lines of data to display at once on the screen. Change this value to suit your computer and display. VS% should equal the number of lines on your display minus four. For example, if your display holds 16 lines, use VS%=12.

Lines 40 to 70 initialize all game strategy elements GS$(,) to 0, indicating that none of the moves has yet resulted in a loss. Line 80 sets the starting pile size SZ% to 21. For a shorter game, you may set SZ% equal to 5, 9, 13, or 17.

Line 90 selects the player who will start the game. The function RND(2) should return a random value of

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either 1 or 2. For Apple and other computers, you will need to change this line to SW%=INT(RND(1)*2)+1 or some similar variation.

Line 120 provides a simple delay whose length is set by the value of WT%. We'll list the subroutine at line 580 later on.

Now type in the next block of lines:

```
130 PRINT TAB(5) STRING$(PL%,"!")
140 PRINT "PILE CONTAINS" PL%;
150 ON SW% GOSUB 380,520
160 IF PL%<2 THEN 190
170 GOSUB 360
180 GOTO 120
190 IF SW%=2 AND DS%=1 THEN GS%(DP%,DM%)=1
200 PRINT PL$(SW%) "WINS!"
210 PRINT
```

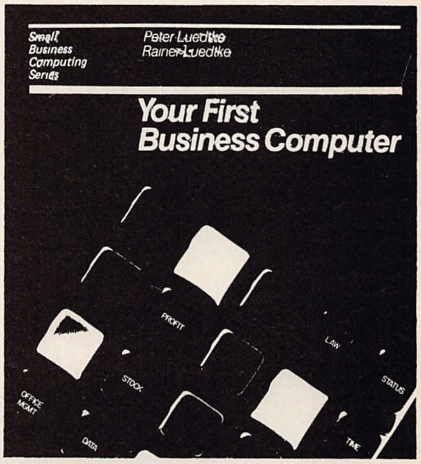
Line 130 displays a facsimile of the current pile. Delete this line if your computer doesn't have STRING$. Line 140 prints the number of sticks in the pile. Depending on the value of SW% (either 1 or 2), line 150 calls the subroutine for the computer's turn or the subroutine for the player's turn. Upon the program's return from the subroutine, the pile size PL% has been reduced by the amount of the last move.

If two or more sticks remain (line 160), the next player must move. Line 170 calls the subroutine for switching players, and line 180 loops back to the start of the next turn.

If fewer than two sticks remain (line 160), then the most recent player is by definition the winner. Line 190 determines whether the loser is the computer. If the computer lost, the game strategy array is updated. GS%(DP%,DM%) refers to the computer's most recent move. Line 200 announces who won.

The following lines determine the computer's action at the end of a game. Type them in now.

```
220 INPUT "PLAY AGAIN (Y/N)?"; A$
230 IF A$="Y" THEN 90
240 IF A$="N" THEN 270
250 PRINT "TYPE Y OR N"
260 GOTO 220
270 INPUT "SEE THE STRATEGY (Y/N)";A$
280 IF A$="N" THEN END
290 IF A$<>"Y" THEN 270
300 FOR I=SZ% TO 1 STEP -1
310 J=SZ%-I+1
320 IF (J-1)/VS%=INT((J-1)/VS%) THEN GOSUB 600
330 PRINT I; TAB(7) GS%(I,1);GS%(I,2); GS%(I,3)
340 NEXT I
350 END
```



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If you choose to play again, the computer starts over, retaining the game strategy developed in previous games (lines 220 to 230). If you choose to quit, the computer gives you a chance to see its strategy table. Lines 300 to 340 display the strategy table.

The next two lines switch players at the end of each turn:

```
360 IF SW%=1 THEN SW%=2: RETURN
370 SW%=1:RETURN
```

The subroutine for the computer's turn is contained in lines 380 to 510. Type them in.

```
380 WT%=500: GOSUB 580
390 PRINT ", COMPUTER TAKES";
400 I=1
410 IF GS%(PL%,I)=1 THEN 460
420 DS%=1
430 DP%=PL%
440 DM%=I
450 GOTO 480
460 I=I+1
470 IF I<3 THEN 410
480 PRINT I
490 PRINT
500 PL%=PL%-I
510 RETURN
```

The computer starts each turn by evaluating the first move, "take 1 stick from the pile" (lines 400 and 410). The rating for this move is contained in array element GS%(PL%,I) because PL% contains the pile size and I equals 1. If that move is rated okay (0), the computer makes the move and records it as its most recent decision (lines 420 to 450). The variables DS% and DM% contain the pile size and quantity taken for the computer's most recent move.

However, if the move has a bad rating (1), the computer looks at the next move, "take 2 sticks from the pile" (line 460). If the move is rated 0, the computer makes the move and records it as its most recent decision. On the other hand, if that move too has a bad rating, the computer must accept the third possible move, "take 3 sticks from the pile." This move is forced because it is impossible for all three moves to have a bad rating (lines 470 to 490). Line 500 updates the current pile size by the amount taken.

The subroutine for the player's turn consists of lines 520 to 570.

```
520 PRINT ", PLAYER'S TURN"
530 INPUT " TAKE 1, 2, OR 3"; I
540 PRINT
550 IF I<1 OR I>3 THEN 530
560 PL%=PL%-I
570 RETURN
```

Lines 580 and 590 comprise a delay subroutine, with the length of the delay determined by the variable

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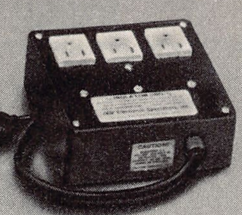

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A sample run that shows the first two games of the Matchstick program played with nine sticks.

```
   !!!!!!!!!
PILE CONTAINS 9 , PLAYER'S TURN
  TAKE 1, 2, or 3? 1

   !!!!!!!!
PILE CONTAINS 8 , COMPUTER TAKES 1

   !!!!!!!
PILE CONTAINS 7 , PLAYER'S TURN
  TAKE 1, 2, or 3? 2

   !!!!!
PILE CONTAINS 5 , COMPUTER TAKES 1

   !!!!
PILE CONTAINS 4 , PLAYER'S TURN
  TAKE 1, 2, or 3? 3

PLAYER WINS!

PLAY AGAIN (Y/N)? Y

   !!!!!!!!!
PILE CONTAINS 9 , PLAYER'S TURN
  TAKE 1, 2, or 3? 1

   !!!!!!!!
PILE CONTAINS 8 , COMPUTER TAKES 1

   !!!!!!!
PILE CONTAINS 7 , PLAYER'S TURN
  TAKE 1, 2, or 3? 2

   !!!!!
PILE CONTAINS 5 , COMPUTER TAKES 2

   !!!
PILE CONTAINS 3 , PLAYER'S TURN
  TAKE 1, 2, or 3? 2

PLAYER WINS!
```

A perfect-game strategy table for the Matchstick Game when played with nine sticks.

```
         MOVE
 PILE  1  2  3
 -------------
   9   1  1  0
   8   1  1  0
   7   1  0  0
   6   0  0  0
   5   1  1  0
   4   1  1  0
   3   1  0  0
   2   0  0  0
   1   0  0  0
```

WT%. Lines 600 to 640 cause a heading to be displayed at the top of the screen when the computer compiles the game strategy table at the end of a game.

```
580 FOR W%=1 TO WT%:NEXT W%
590 RETURN
600 INPUT "PRESS <ENTER> TO CONTINUE"; A$
610 PRINT TAB(9) "MOVE"
620 PRINT " PILE  1  2  3"
630 PRINT " ----------"
640 RETURN
```

A sample run of the program, along with a perfect-game strategy table, is shown above. To speed up the game, we set the initial pile size to 9 instead of 21 (in line 80, SZ%=9). Run the program you typed in and compare the results. After 12 losses, the computer should have developed a perfect strategy. □

Do you have questions about this program or suggestions for future projects? Send them to The Program Factory, POB 397, Hancock, NH 03449. For listings of previously published programs, send a self-addressed, stamped envelope and specify which computer you have.

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COMING UP

Special Issue—Computers in Education

Contributing Editor Dan Watt, who has written our Educational Computing column for the last two years, has pulled together an extraordinary special report on computers in education—a series of features and software reviews that really gets to the heart of how computers are changing the way we absorb and share knowledge.

In addition to our overview of the innovative programs affecting high school and collegiate computing, you'll get a trip to New York City's Bank Street School, a private elementary school where computers help kids become better thinkers and communicators. That's a nice entree to a review of Bank Street Writer, one of the most significant pieces of educational software to emerge in years. "Urban Adventure" is an inside look at how instructional programs are written for—and *with*—kids. Then there's a practical, get-your-feet-wet introduction to the Logo language—why it's important in education and how the Apple, Texas Instruments, Commodore, and TRS-80 Color Computer versions of Logo compare.

The Discovery Games

The Discovery series—16 games for the Apple created by the Children's Television Workshop (part of the same outfit that gives you *Sesame Street*)—is perhaps the most delightfully nonviolent group of computer games you're likely to find on the market. Despite the absence of alien-zapping and creature-squishing, games like Instant Zoo really hold kids' attention.

Computers on Broadway

The margin of profit on Broadway shows just isn't what it used to be back in the George S. Kaufman days. That's why computer-controlled lighting systems are such good investments on the Great White Way. We'll take a look at the equipment that controls the lights that fall on all those chorus lines and fe-lines in Broadway hits such as *Cats* and *Dream Girls*.

Turning Game Machines into Computers

We're starting to see plenty of hardware add-ons that promise to turn video-game machines into "real" computers. For example, you can add 8K bytes and a keyboard overlay to the Atari 2600 game machine; a programming module turns Magnavox's Odyssey game system into a computer, too. The question, of course, is very simple: Should you pay for the add-ons or simply purchase a low-cost computer?

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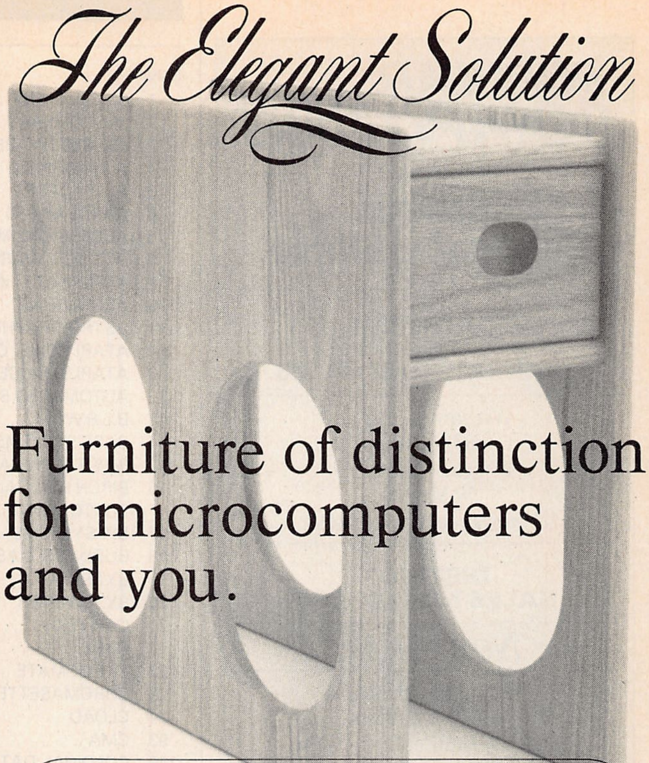

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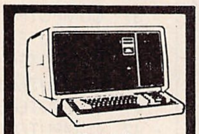

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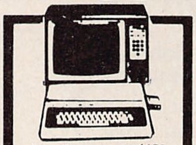

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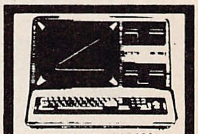

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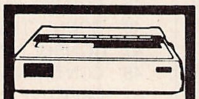

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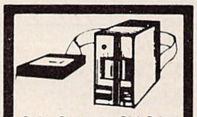

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4	AARDVARK-80	248
5	ACCESS UNLIMITED	205
6	ACE SOFTWARE STORES	242
8	APPLEWARE INC.	228
9	ARCHIVE INC.	240
11	ASTRO GRAPHICS SERV.	35
154	ATARI COMP. CAMPS	197
49	ATARI SERVICE CENTERS	153
12	AUTOMATED SIMULATIONS	87
13	B.L.&W.	170
14	BASF SYSTEMS	129
15	BAY TECHNICAL ASSOC.	220
16	BIRCH HILL SALES	224
*	BOTTOM LINE, THE	19
17	BPI SYSTEMS, INC.	81
18	BUSINESS MASTER CO.	211
19	BYTE BACK	32
20	BYTEWRITER	50
21	CAB-TEK	204
*	CDEX	64
22	CHECK-MATE	233
23	CHROMASETTE	230
24	CLOAD	230
93	CMA	254
149	COLONIAL DATA	197
25	SAFEWARE	225
26	COMMODORE BUSN.MACHINES	23
27	COMMUNICATIONS ELECTRONICS	163
28	COMPAQ	39
29	COMPONENTS EXPRESS,INC.	45
30	COMPU SENSE	27
31	COMPU-HAUS	226
32	COMPUPRO/GODBOUT	49
33	COMPUSERVE	79
34	COMPUSHACK	36, 37
35	COMPUSOFT PUBLISHING B	247
36	COMPUTER DISC.OF AMER.	242
37	COMPUTER EXCHANGE	68, 69
38	COMPUTER MAIL ORDER	12, 13
39	COMPUTER OUTLET	234, 235
40	COMPUTER PLUS	255
41	COMPUTER SHOPPER	244
42	COMPUTER SPECIALTIES	209
43	COMPUTERLAND	103
44	COMPUTERLINE	207
45	COMREX INTERNATIONAL INC.	127
46	CONNECTICUT INFO SYS.	217
47	CONSULTANT SYSTEMS, INC.	184
48	CONTINENTAL SOFTWARE	137
51	CREATIVE COMPUTERS	174
52	CUESTA SYSTEMS	219
53	DATA 20 CORP.	24, 25
54	DELUXE COMP. FORMS	160
55	DENNISON KYBE CORP.	159
56	DEWEESE WOODWORKING	222
57	DIGITAL MARKETING	5
58	DIGITAL PRESS	252
147	DISKAZINE	210
59	DOUTHETT ENTERPRISES	125
60	DYNAX	177
61	EAGLE COMPUTER	143
62	EDU-WARE SERV.INC.	42
63	ELECTRONIC PROTECTN DEVCS.	55
64	ELECTRONIC SPECIALISTS	254
65	EPSON AMERICA INC.	52, 53
66	EPSON AMERICA INC.	175
67	EXECUTIVE SOFTWARE	21
68	EXECUTIVE SOFTWARE	215
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72	GREAT PLAINS SOFTWARE	167
73	H & E COMPUTRONICS	15
*	HAPPY HANDS COMPUTER	226

Inquiry		Page
75	HAYES MICROCOMP.PROD.	71
76	HAYES MICROCOMP.PROD.	168, 169
78	HEATH CO.	246
79	HEWLETT-PACKARD	47
80	I.T.M.	202
81	IBM	63
82	INFOCOM	151
83	INFORMATION UNLMTED S/W	40, 41
85	INTEGRAL DATA SYS	111
86	INTERACTIVE STRUCTURES	145
87	JIMSCOT,INC.	180
148	JUST WOOD, INC.	35
89	LEADING EDGE PROD.	CII, 1
90	LEXINGTON STATE BK.&TRUST	199
91	LNW RESEARCH	165
*	MACMILLAN BOOK CLUBS	229
94	MASON COMPUTERS	32
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*	MEMOTECH CORP.	31
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104	NEC HOME ELECTR.USA	162
105	NEW LEAF	212
106	OKIDATA CORP.	33
107	OMNI RESOURCES	203
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*	PRECISION DATA PRODUCTS	208
*	PRELUDE PRESS	157
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*	PROGRAMMING INT'L.	172, 173
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152	RCE	201
153	RCE	201
116	RED BARON COMP.PROD.	195
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*	SCM	3
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118	SJB DISTRIBUTERS	186
145	SOFTREND	117
151	SOFTWARE BANC	218
119	SOFTWARE MODELS	210
120	SOFTWARE POWER	200
121	SOFTWARE PUBLISHING	154, 155
123	SOFTWARE SOURCE	181
150	SOFTWARE TOOLWORKS	197
124	SOLUTIONS	62
*	SORCIM CORP.	8, 9
125	SSM	227
126	SSM	51
127	STAR PRINTER	189
128	STAR MICRONICS, INC.	121
129	SYBEX	135
130	SYNCHRO-SETTE	253
131	TII ELECTRONICS	179
132	TERRAPIN INC.	245
133	TYMSHARE	141
134	U.S. ROBOTICS	14
135	UNITED COMPUTER	11
136	USER FRIENDLY SFTW.	253
*	VENICE WOODWORKING	255
*	VIRTUAL COMBINATICS	76
139	WASHINGTON COMP.SERV.	204
7	W.D.S.	164
140	WESPER MICRO SYSTEMS	191
141	WESTWARE	80
142	WORKS, THE	221
143	WYNDHAM GROUP	222
144	XEROX EDUCATION PUB.	56, 57

*Corresponding directly with company

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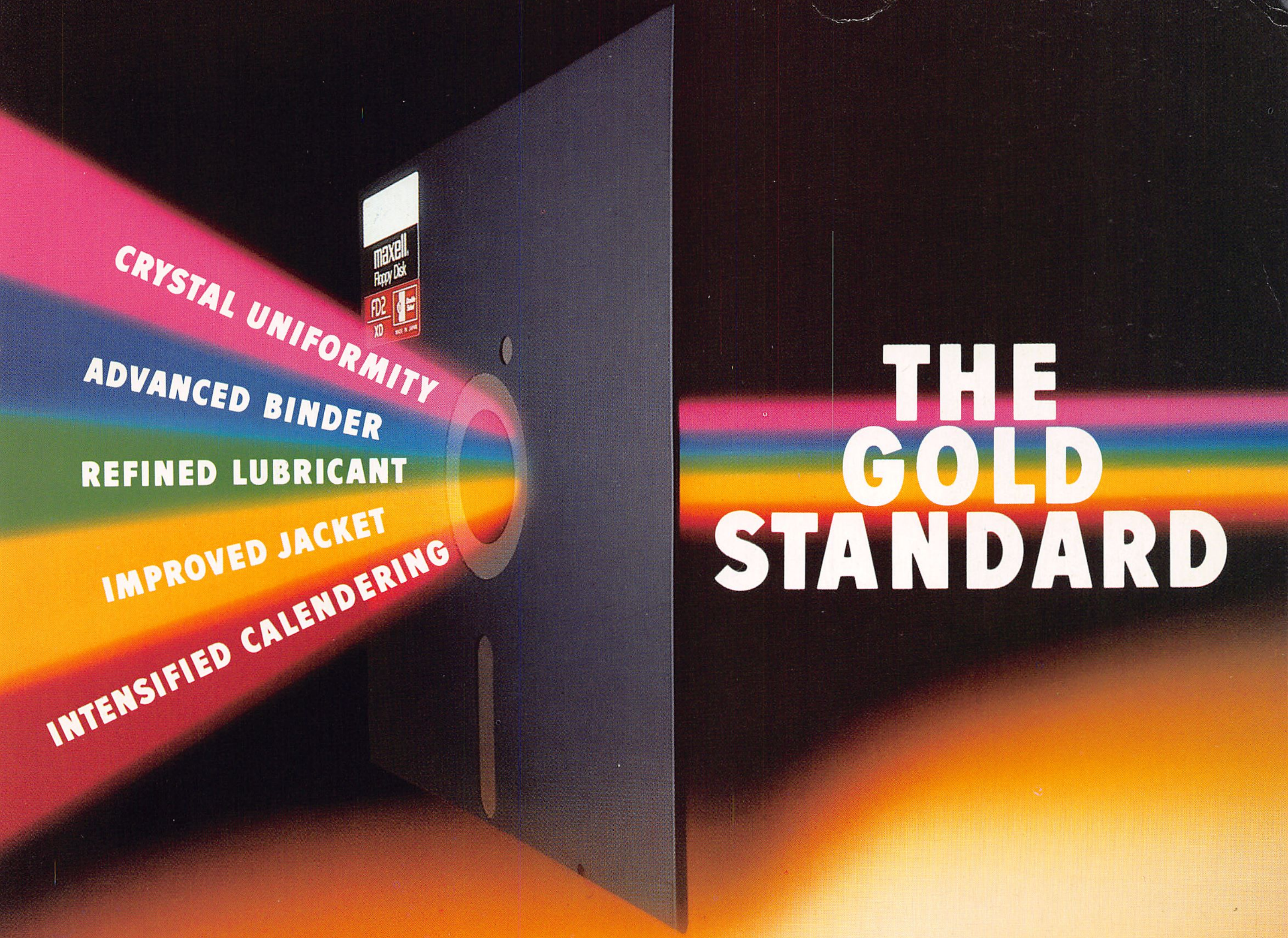
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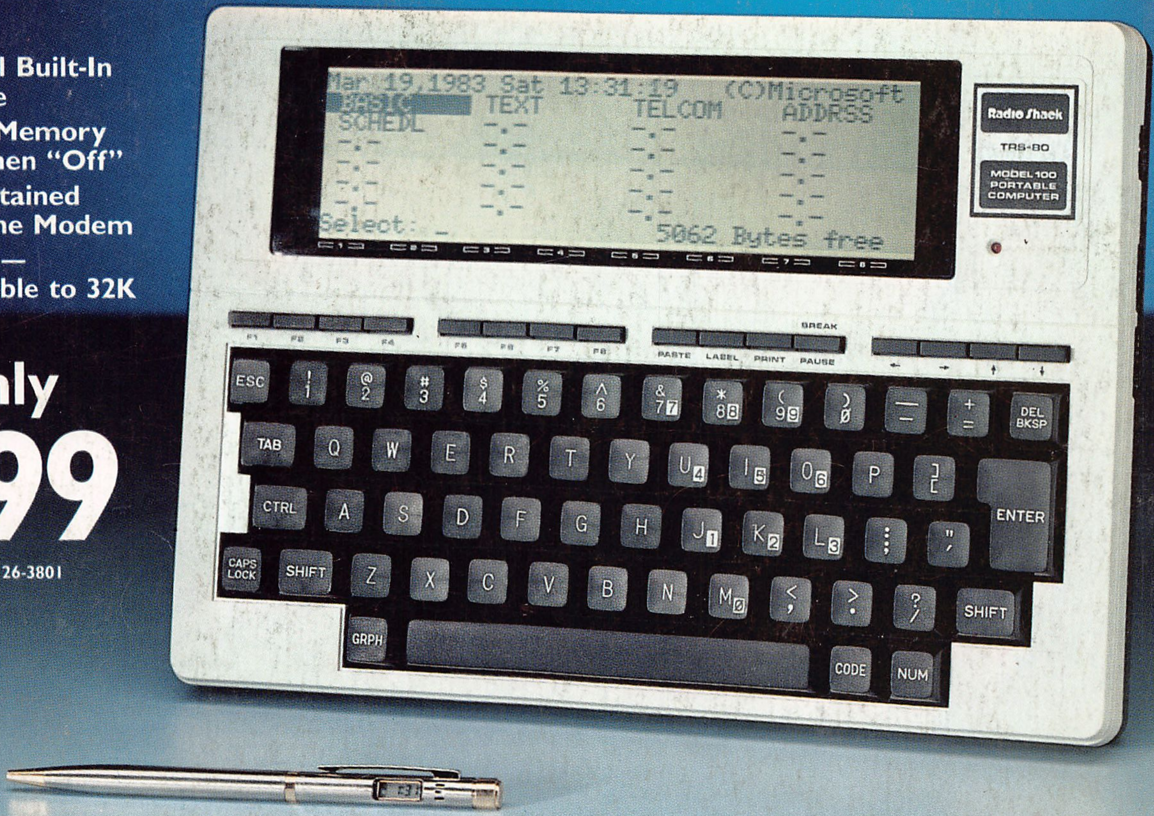
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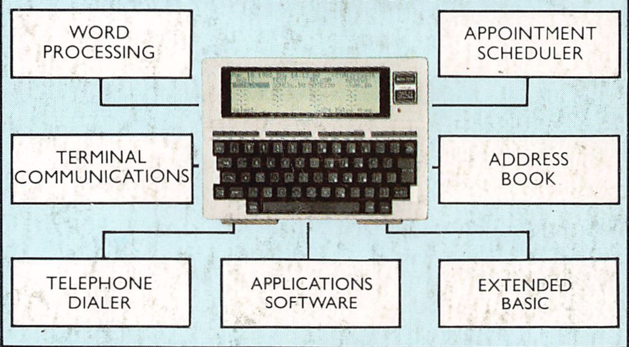
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